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WATER SUPPLY AND WATER QUALITY CONTROL STUDY, CONEMAUGH RIVER BASIN, PENNSYLVANIA. A STUDY OF NEEDS AND VALUE OF STORAGE FOR WATER SUPPLY AND WATER QUALITY CONTROL

Environmental Protection Agency
Wheeling, West Virginia

December 1971

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Water Supply and Water Quality Control Study

Conemaugh River Basin

Pennsylvania

A Study of Needs and Value of Storage for Water Supply and Water Quality Control

Prepared for
DEPARTMENT OF THE ARMY
United States Army Engineer District
Pittsburgh, Pennsylvania

by

U. S. Environmental Protection Agency
Region III
Wheeling Field Station
Wheeling, West Virginia

December 1971

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I. INTRODUCTION

REQUEST AND AUTHORITY

In a letter dated August 1, 1968 the U. S. Army Corps of Engineers requested the Federal Water Pollution Control Administration (now within the Environmental Protection Agency) to make a study of the Conemaugh River basin with respect to potential water development for water quality control.

This report was prepared pursuant to section 3 (b) of the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq.).

PURPOSE AND SCOPE

The purpose of this study is to determine the need for and value of storage of water for municipal and industrial supply and for quality control in the Conemaugh watershed.

The area included in this study encompasses portions of Cambria, Indiana, Somerset and Westmoreland counties in southwestern Pennsylvania.

Storage demands and benefits for the various points of need have been evaluated for the period 1960 to 2020. This study period is consistent with the period for which economic guidelines have been established and with other Ohio River Basin reports.

ACKNOWLEDGMENTS

Information and cooperation provided by the following organizations are gratefully recognized:

U. S. Army Engineer District, Pittsburgh, Pennsylvania

U. S. Geological Survey, Pittsburgh, Pennsylvania

Pennsylvania Department of Environmental Resources

Clymer Water Service Company, Indiana, Pennsylvania

City of Ebensburg, Ebensburg, Pennsylvania

Greater Johnstown Water Authority, Johnstown, Pennsylvania

Highland Sewer and Water Authority, Johnstown, Pennsylvania

Municipal Authority of the Borough of Derry, Derry, Pennsylvania

Richland Township Water Company, Windber, Pennsylvania

II. SUMMARY OF FINDINGS AND CONCLUSIONS

FINDINGS

1. The study area encompasses the Conemaugh River basin above the existing Conemaugh River Reservoir and includes parts of four counties. The drainage area of the basin is about 1340 square miles.

2. The population of the study area was about 356,000 in 1960. The study area is fairly evenly divided between urban and rural, with rural being about 56 percent.

3. The economy is largely dependent on mining and manufacturing, with manufacturing including lumber and wood products, primary metals, machinery, and apparel and related products.

4. There are 17 significant sources of waste other than mining related in the basin, of which two provide secondary treatment and three primary treatment. Many communities and most sources of industrial waste are not presently providing any treatment because of the extreme acid conditions of many of the receiving streams.

5. There are nine major municipalities in the basin, all of which use surface water for water supply. The present municipal water use is approximately 17 million gallons per day (mgd). Most communities use reservoirs in undisturbed watersheds for water supply thus requiring only chlorination for good drinking water. The smaller water-using industries obtain water from municipal systems while several large water users, such as the steel mill at Johnstown and electric power stations, have their own reservoir water supply or use existing stream flow.

6. The quality of surface water in the basin, in general, is seriously degraded by mine drainage. The potential for low dissolved oxygen (D. O.) levels exists below many of the communities in the basin, but the biochemical oxygen demand (BOD) is in most cases masked by the acid in the streams. Groundwater quality is not entirely satisfactory as high concentrations of iron are prevalent throughout the basin.

CONCLUSIONS

1. Population of the study area is projected to increase to about 455,000 by the year 2020, or about a 28 percent increase.

2. The Highland Sewer and Water Authority projects a need for additional water in the future, but is nearing the construction stage for the expansion of facilities. The community of Derry is in a preliminary planning stage for possible construction of an additional intake structure to be used for filling an existing reservoir. This additional intake, plus the installation of water meters, should be sufficient to meet projected needs during the study period.

3. Based on economic projections and estimated waste loadings, water quality control measures in addition to secondary treatment providing substantially complete removal of all floatable and settleable solids, and 85 percent removal of five day BOD (BOD_5) and suspended solids, based on design flow, are needed in the basin.

4. The communities requiring waste treatment greater than secondary are so located in the basin that flow regulation from the proposed reservoirs would not be usable as an alternative to advanced waste treatment.

5. Flow regulation, in conjunction with a comprehensive mine drainage remedial program, would improve the quality of the Conemaugh River above the existing Conemaugh Reservoir. Flow regulation, however, in itself, would have a minimal effect on the total quality of the Conemaugh Reservoir water either with or without a remedial mine drainage program.

6. The values of water quality control benefits deriving from the proposed reservoirs for municipal and industrial water supply were found to be negligible.

7. The intangible benefits associated with recreation, aesthetics and fishing which result from adequate water quality control measures were considered, but a suitable rationale for expressing these benefits in monetary terms was not devised. It should be noted that stream reaches in the basin presently suitable for water based recreation are very limited.

8. The proposed reservoir on Clear Shade Creek will flood an existing water supply reservoir which presently requires only chlorination. A multi-purpose reservoir would require the construction and operation of a water treatment filtration plant, resulting in a negative annual benefit of $44,000 based on a reservoir life of 100 years.

III. DESCRIPTION OF PROJECT

The Pittsburgh District, Corps of Engineers, initiated a study of the Conemaugh River basin to determine needs for flood protection, water supply, recreation, and water quality control. Six reservoir site possibilities determined in a preliminary phase I investigation were subsequently narrowed down to two sites due to coal reserves and undermining at the other four sites.

The site on Clear Shade Creek will control a 31 square mile drainage area and allow 26,000 acre-feet for summer water quality control. The site on Stoney Creek will control a 73 square mile area and allow 20,700 acre-feet for summer water quality control.

IV. DESCRIPTION OF THE STUDY AREA

SIZE OF BASIN, TOPOGRAPHY AND GEOGRAPHY

The study area includes the part of the Conemaugh River drainage basin which extends above the Conemaugh Reservoir referred to as the upper Conemaugh River drainage basin. Overall length (east to west) of the basin, by airline distance, is approximately 32 miles. The basin varies in width from 28 miles in the lower portion to 50 miles in the headwater region (See Figure 11). The total upper Conemaugh River basin drainage area is approximately 1,340 square miles of which 1,065 square miles are drained by three principal tributaries: Stony and Blacklick Creeks and Little Conemaugh River.

The topography of the watershed varies considerably. The most prominent topographic features are the Allegheny Mountains, Laurel Hill and Chestnut Ridge. In general, the aforementioned features are characterized by the eastern slopes having a distinct dipping plateau-like topography that includes some broad flats and steep valley slopes. The western slopes are characterized by smooth rolling and hilly areas consisting of ridges, broad divides, flat saddles and rounded hills. Hilltop elevations (above sea level) range from 1,200 feet on the western part to above 2,800 feet on the eastern part of the drainage basin with gorges over 1,000 feet deep. The pool elevation of the Conemaugh Reservoir at full capacity is 975 feet. A large percentage of the basin land area is suitable for growing crops and ranks high agriculturally.

The humid, continental climate of the study area is characterized by warm summers and cold winters. Precipitation is considered to be adequate and normally well distributed. Prevailing winds are from the west and bring most of the major pressure systems that affect the area. Air currents are mainly from the polar region, but during the summer, invasions of air currents from the Gulf of Mexico are frequent and result in warm, humid weather. During the winter months, however, the invasions of air currents are less frequent, which accounts for the alternate periods of freezing and thawing.

Because elevation and slope differ within short distances, there are local differences in the climate. Temperatures, on the average, are alightly higher and rainfall is somewhat less in the valleys than at higher elevations. Freezing temperatures occur later in the spring and earlier in the fall in the valleys. Therefore, the growing season is somewhat shorter in the valleys. The average annual temperatures range from 44 degrees at Stoystown (elevation approximately 2200 feet) to 51 degrees at Johnstown (elevation approximately 1200 feet). The monthly average temperatures

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range from approximately 18 degrees in February at Stoystown to 75 degrees in July in Johnstown. 1/

The growing season ranges from around 100 days to over 200 days with an average growing season of about 150 days. The average annual precipitation ranges from about 35 inches at Stoystown to 43 inches at Ebensburg.

STREAM CHARACTERISTICS

The basin is drained westward to the Kiskiminetas River with streams east of the Chestnut Ridge generally more active and having deep, narrow channels in contrast to those west of the Ridge which have formed bottoms or terraces, or both, in most places. The bottoms may be a few feet wide and the terraces a mile or more wide. The characteristics (length, drop in elevation and slope) of some of the streams in the basin are listed as follows:

Stream	Length (miles)	Drop in elevation (feet)	Slope (ft./mi.)
Conemaugh River	23.3	185	7.9
South Fork, Little Conemaugh	15.0	1320	88.0
Little Conemaugh River	31.0	855	27.6
North Branch-Little Conemaugh	10.0	460	46.0
Stony Creek	34.0	1100	32.4
Quemahoning	15.5	500	32.3
Shade Creek	9.3	540	58.0
Clear Shade Creek	12.0	640	53.3
Dark Shade Creek	9.0	780	86.7
Blacklick Creek	22.0	425	19.3
North Branch Blacklick Creek	15.0	600	40.0
South Branch Blacklick Creek	14.0	700	50.0
Two Lick Creek	27.0	325	12.0
Yellow Creek	23.5	900	38.3
Little Yellow Creek	12.0	700	58.3

The stream length and drop in elevation over the total stream length for the aforementioned streams were computed from 15 minute USGS topographic maps. The slope of each stream was computed as an average for the total length of stream.

1/ Temperatures and precipitation information were taken from Pennsylvania's "Climatological Data", U. S. Department of Commerce, Environmental Science Services Administration, Annual Summary, 1968, Vol. 73 No. 13.

PRINCIPAL COMMUNITIES AND INDUSTRIES

Johnstown, Pennsylvania is the major center of population and economic activity in t' 'n. It accounts for over one-third of the total urban popula :he entire basin.

The study area contains a number of significant communities. Therefore, the data on these communities and their industries are presented in tabular form below:

Conemaugh River Basin Study

Principal Communities

Communities	1960 Population	County	Industry
Johnstown	53,949	Cambria	Meat packing; meat products; dairy products; canning, bakery products; candy, bottling; clothing; lumber millwork products; furniture and fixtures; paper and allied products; printing, publishing, and allied products; industrial gases; stone and clay products; primary metal; machinery; electrical machinery, fabricated metal; transportation equipment, instruments-surgical and medical; and miscellaneous manufacturers.
Nanty Glo	4,608	Cambria	Dresses; sawmills and planing mills, and miscellaneous machinery, except electrical.
Ebensburg	4,111	Cambria	Dairy products; food preparations; sawmills and planing mills; general; furniture and fixtures; newspapers and letterpress printing; noncurrent-carrying wiring devices; transportation equipment; and signs and advertising displays.

Community	1960 Population	County	Industry
Portage	3,933	Cambria	Prepared feeds for animals and fowl; corsets and allied garments; raincoats and other waterproof outer garments; sawmills and planing mills; hardwood dimensions and flooring mills; wood products; newspapers and concrete products.
Cresson	2,659	Cambria	Fluid milk; dresses and Cathode ray picture tubes.
South Fork	2,053	Cambria	Corsets and allied products; sawmills and planing mills; grayiron foundries; electroplating, plating, polishing, anodizing and coloring.
Lilly	1,642	Cambria	Sportswear
Indiana	13,005	Indiana	Meat packing; fluid milk; bread and other bakery products; bottled and canned soft drinks and carbonated waters; apparel and related products; printing, publishing and allied products; industrial gases; paving mixtures and blocks; tires and inner tubes; leather goods; stone and glass products; primary and fabricated metal products; machinery except electrical; and automatic temperature controls.
Blairsville	4,930	Indiana	Apparel and related products; lumber and wood products; newspaper; concrete products; primary and fabricated metals.

Community	Population	County	Industry
Homer City	2,471	Indiana	Bread and other bakery products; lumber and wood products.
Clymer	2,245	Indiana	Clay refractories.
Windber	6,994	Somerset	Ice cream and frozen desserts; fluid milk; bakery products; corsets and allied products; childrens' clothes; publishing; noncurrent-carrying wiring devices; and transportation equipment.
Central City	1,604	Somerset	Bottled and canned soft drinks; and saw mills and planing mills.
Boswell	1,508	Somerset	Saw mills and planing mills; hardwood dimension and flooring mills and newspapers.
Hooversville	1,120	Somerset	Meat packing (slaughtering)
Holsopple	900	Somerset	Prepared feed for animals and fowl; and childrens apparel.
Stoystown	360	Somerset	Saw mills and planing mills; leather products; and fabricated plate works.
Derry	3,426	Westmoreland	Fluid milk, bakery products; explosives; fabricated rubber; porcelain electrical supplies; lime; nonclay refractories; fabricated metals; and machinery, except electrical.

Source: Pennsylvania Industrial Directory, Department of Internal Affairs, 1965.

V. WATER RESOURCES OF STUDY AREA

SURFACE WATER

Quantity

There are several reservoirs in the study area controlled by the Greater Johnstown Water Authority and Bethlehem Steel. The Quemahoning Reservoir is the largest, covering an area of over 100 acres and is used for water supply and recreation. In addition, there are over ten reservoirs with a capacity between 18 and 1,260 million gallons used for municipal and industrial water supply. There are no known reservoirs with supplemental storage for low flow stream augmentation. Table I , presents a description of the various USGS stream gaging stations in the basin along with the drainage area, length of recrod, maximum, minimum, mean and low flow characteristics. The 7-day mean once in 10-year frequency low flow data at these stations were used in computing the low flow frequency analysis at the various waste discharge points to the stream by making adjustments for drainage area.

In general, there appears to be sufficient surface water resources in the area if proper conservation and distribution measures are carried out.

The average annual run-off ranges from about 1.2 to 1.8 cubic feet per second per square mile.

There are eight streamflow gages in the study area at which discharge measurements are made by the U. S. Geological Survey on a continuing basis. The stations are listed below and shown on the base map in the Appendix.

1. USGS No. 3-0392 Clean Run near Buckstown, Pennsylvania
2. USGS No. 3-0400 Stony Creek at Ferndale, Pennsylvania
3. USGS No. 3-0410 Little Conemaugh River at East Conemaugh, Pa.
4. USGS No. 3-0415 Conemaugh River at Seward, Pennsylvania
5. USGS No. 3-0420 Blacklick Creek at Josephine, Pennsylvania
6. USGS No. 3-0422 Little Yellow Creek near Strongstown, Pennsylvania
7. USGS No. 3-0422.5 Yellow Creek near Penn Run, Pennsylvania
8. USGS No. 3-0425 Two Lick Creek at Graceton, Pennsylvania

In addition to the eight points of continuous discharge measurements made, periodic data have been collected at other points in the basin by USGS and discontinued or made during low flow periods. A list of the streamflow gages and a summary of the data are shown in Table 1.

Quality

The major pollution problem in the watershed above the existing Conemaugh Reservoir is acid mine drainage. Data from a 1966 stream survey, conducted by the Wheeling Field Office of the Environmental Protection Agency, Region III, indicates that an average acid load of about 640 tons per day enters Conemaugh Reservoir. As a result, the water in the Conemaugh Reservoir has such a low pH that aquatic life consists of only pollution tolerant types.

The acid from the Conemaugh River persists throughout the length of the Kiskiminetas River and is finally neutralized in the Allegheny River. The Pennsylvania Department of Environmental Resources, in a memorandum dated September 7, 1966, concluded that when the percentage of Kiskiminetas water in the Allegheny River at Natrona increases appreciably above 15 percent, water quality begins to deteriorate in the Allegheny River. Experience has taught that when the 20-25 percent level is reached, the pH will drop to a critical value and fish kills can be expected in the Allegheny River. The variation in percentage is dependent upon a combination of factors such as water temperature, length of duration of increased flow from the Kiskiminetas, quality of water being released from Conemaugh and/or Loyalhanna Reservoirs, and possibly unknown factors. A detailed, computerized analysis[1/] of this problem performed by the Environmental Protection Agency, Region III in 1967 concluded that the 20% level could be held under most conditions by proper reservoir operation.

The following Figure I shows the acid loading found in the 1966 survey to the Conemaugh Reservoir from Blacklick Creek, Two Lick Creek, and the Conemaugh River.

The results of a 1968 mine drainage source investigation conducted jointly by the Environmental Protection Agency, Region III and the Pennsylvania Department of Environmental Resources in the watershed above the Conemaugh Reservoir are presented in Appendix A.

1/ Gitto et al, "Streamflow Regulation for Acid Control", p. 2.

Table 1

Upper Conemaugh River Basin Study

Stream Flow Data*

U.S.G.S. Gage No.	Gage Location	Drainage Area (sq.mi.)	Years Record	Maximum Discharge (cfs)	Minimum Discharge (cfs)	Mean Discharge (cfs)	7-Day 10 year Low Flow (cfs)	1-Day 30 year Low Flow (cfs)
3-0392	Clean Run near Buckstown, Pa.	3.68	1961-1964** 1964-1967	250	0	4.71	0	
3-0394	Stony Creek at Hooversville, Pa.	136.0	Miscellaneous Measurements 1938					
3-0395	Stony Creek at Hollsopple, Pa.	244.0	1937-1940	12,800	5.2	343 1/		
3-0398	Clear Shade Creek at Ogletown, Pa.	5.17	1959-1967 2/				1.5	1.2
3-0400	Stony Creek at Ferndale, Pa.	451.0	1913-1936 1938-1967	59,000	5.0	732 3/	15	
3-0410	Little Conemaugh River at East Conemaugh, Pa.	183.0	1939-1967	12,300	3.4	309 3/	5.8	
3-0415	Conemaugh River at Seward, Pa.	715.0	1938-1967	54,000	105.0	1,222 3/	165	128
3-0420	Blacklick Creek at Josephine, Pa.	192.0	1952-1967	11,900	19.0	331	25	24
3-0422	Little Yellow Creek near Strongtown, Pa.	7.36	1960-1967	541	0.1	11.6	0.1	0.05
3-0422.5	Yellow Creek near Penn Run, Pa.	50.4	1963-1967	3,350	1.2	76.6		
3-0425	Two Lick Creek at Graceton, Pa.	471.0	1951-1967	12,900	2.0	260.0	10	
3-0430	Blacklick Creek at Blacklick, Pa.	390.0	1904-1905 1907-1951	51,700	6.0	671.0	23	10

*Basic data obtained from USGS Water Resources Data for Pennsylvania, Surface Water Records and Water Resources Bulletin No.1, Streamflow Characteristics.
**Annual maximum and occasional discharge measurements for water years 1961-1964.
1/Adjusted for change in contents in and diversion from Quemahoning Reservoir.
2/Miscellaneous measurements during low-flow periods.
3/Adjusted for storage and diversion.

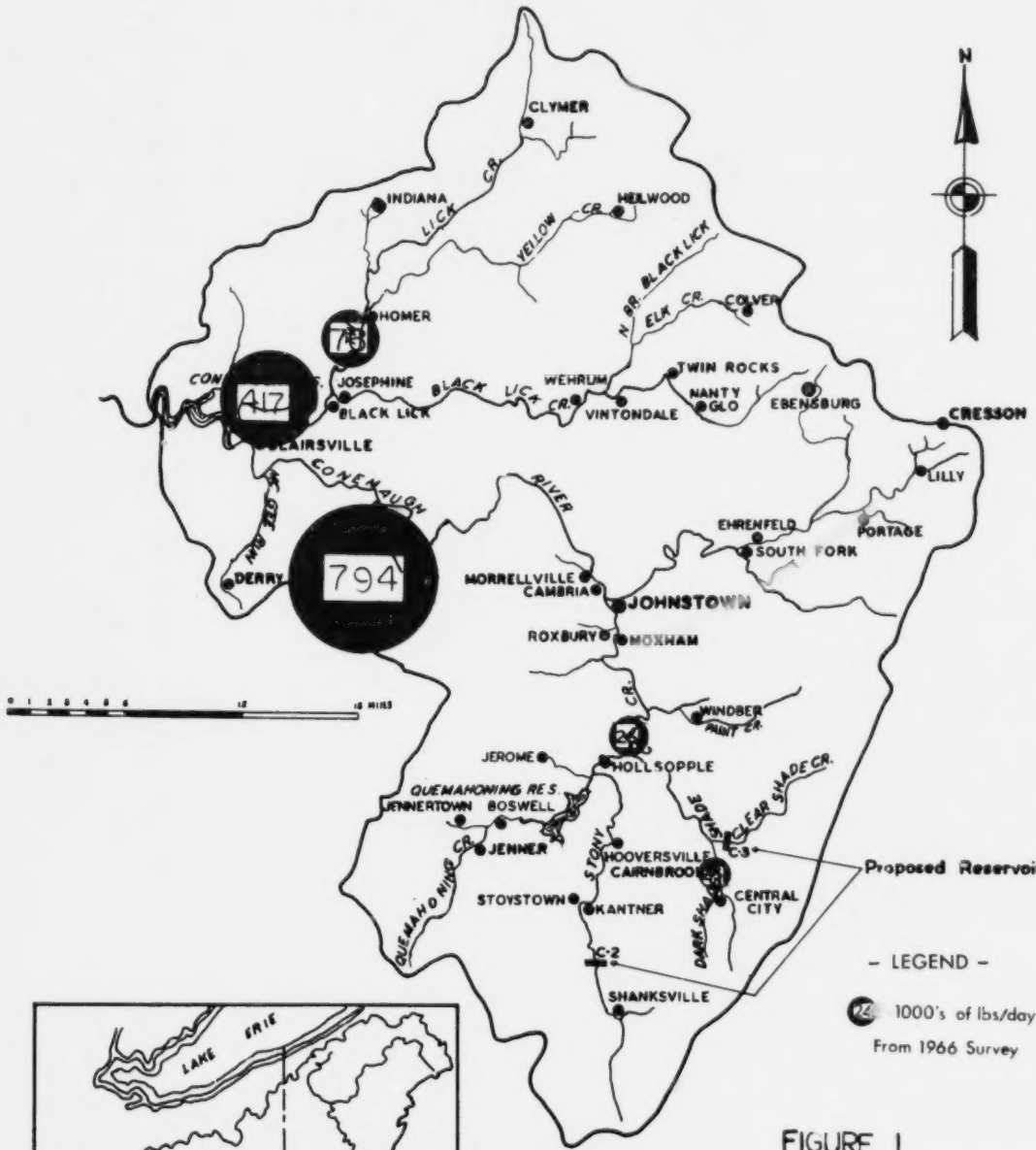


FIGURE 1

UPPER CONEMAUGH R'VER BASIN

ACID LOADING

GROUND WATER

Quantity

Adequate supplies of ground water are available in the basin to meet most of the needs for the present and the foreseeable future. The quantity used is only a small part of the total available supply.

The development of ground water has not been intense and many areas are practically untapped. The principal developments have been in the extensive sandstone aquifers. The most favorable areas for development of relatively large supplies for industrial and municipal needs are underlain by massive sandstones of the Allegheny, Pottsville, and Mauch Chunk Formation and in some of the area underlain by the thick sandstones of the Conemaugh Formation.

Figure ? is a generalized map, showing the potential ground-water resources, based on data that are presently available. However, major groundwater development for industries and communities at specific sites usually requires detailed studies and exploratory drilling to fully define the hydrologic characteristics of the aquifers.

The areas of highest ground-water yields are underlain predominantly by massive, coarse-grained conglomeratic sandstone. These rocks, which underlie almost half the basin area, yield large quantities of fresh ground water of good quality. Yields of wells range from 50 to 600 gpm. Major water-bearing units are the Allegheny and Pottsville Formations of Pennsylvanian age, and the Mauch Chunk Formation of Mississippian age. Principal rock types are sandstone, but shale and minor beds of impure limestone and a few coal beds of commerical importance are present.

Areas of moderate ground-water yield are underlain by coarse-grained sandstone and interbeds of shale. These aquifers, which occur in about half of the basin, yield moderate quantities of fresh ground water of good quality. Yields of wells range from 20 to 150 gpm. Major waterbearing unit is the Conemaugh Formation of Pennsylvanian age. Principal rock types are cyclic sequences of sandstone, shale, thin impure limestone and coals.

Areas of relatively low ground water yield are underlain predominantly by shale with a few interbeds of thin sandstone. These aquifers, which occur only in a few small areas, generally yield only enough ground water for rural domestic and farm supplies. Yield of wells range from 1-20 gpm. The major water bearing unit is the Monongahela Formation of Pennsylvanian age. Principal rock types are non-marine cyclic sequences of shale, sandstone, limestone and coal.

Calculations based on the data obtained from this investigation indicates that an overall reduction of 75 percent of the present acid load to Conemaugh Reservoir may be achieved by comprehensive remedial action. This projected reduction is based on the following assumptions:

(1) All active mines will treat discharges to zero acidity.

(2) Reclamation of inactive strip and refuse areas will achieve a 90 percent load reduction in acid runoff.

(3) Sealing of inactive drift and shaft mines will achieve an area average load reduction of 50 percent in acid drainage.

These measures, if applied, would result in a reduction of the acid load to the Conemaugh River as measured by the 1966 stream survey to about 160 tons per day with a resultant improvement in the water quality of the Conemaugh Reservoir.

A systems analysis of operations of Conemaugh, Loyalhanna and Allegheny Reservoirs determined that it is practical to limit polluted Conemaugh and Loyalhanna outflows to 15 percent of the augmented Allegheny River flow1/, thus preventing the occurrence of fish kills due to mining. Upon completion of a mine drainage remedial program in the upper Conemaugh basin, this 15 percent figure could be raised to near the 40 percent level if more latitude is desired in current operating schedules of the affected reservoirs.

The actual release percentages should be based on chemical analyses as a control guide since reservoir overturn, withdrawal level, and release magnitude could either singly or in combination produce a large fluctuation in release quality as compared to the average water quality in the stream.

With technical assistance from the EPA, Region III, the Corps of Engineers is presently installing a network of four water quality monitors in this area to obtain feedback for reservoir releases. Three monitors are presently in operation on the Kiskiminetas River near the mouth, and on the Allegheny River above and below the mouth of the Kiskiminetas. A fourth monitor is to be installed below the Allegheny Reservoir in the near future.

Background water in the basin is generally of very high quality. Most of the water supplies require only chlorination for good drinking water. Background water has a pH of 6.2 to 8.3, alkalinity varies between 5 and 94 mg/l, while conductance ranges from less than 50 to 630 micromhos per centimeter.

1/ T. L. Reilly, "Allegheny Reservoir's Role in Water Quality", p. 5.

Quality

Coal mining can affect the local occurrence of the ground water but the basinwide effect is negligible. The mines act as additional drainageways for the discharge of ground water and in a few local places apparently have caused a lowering of water levels. The effect of mining on the chemical quality of the ground water apparently does not extend much beyond the immediate area of the mining activities.

In general, the chemical quality of the ground water in the Conemaugh River basin is much better than the chemical quality of the surface streams. The natural chemical character of the ground water is, with some exceptions, satisfactory for most ordinary uses. The iron content and hardness in some places may be high enough to require treatment. Generally, the ground water ranges from soft to hard, low to high in iron content, and is usually low in chloride and dissolved solids.

In some areas, ground water of better chemical quality can be obtained by drilling to an alternate aquifer, but study of local geologic conditions is necessary to determine the best areas and development procedures. Present water-treatment methods can alleviate most of the ground water quality problems.

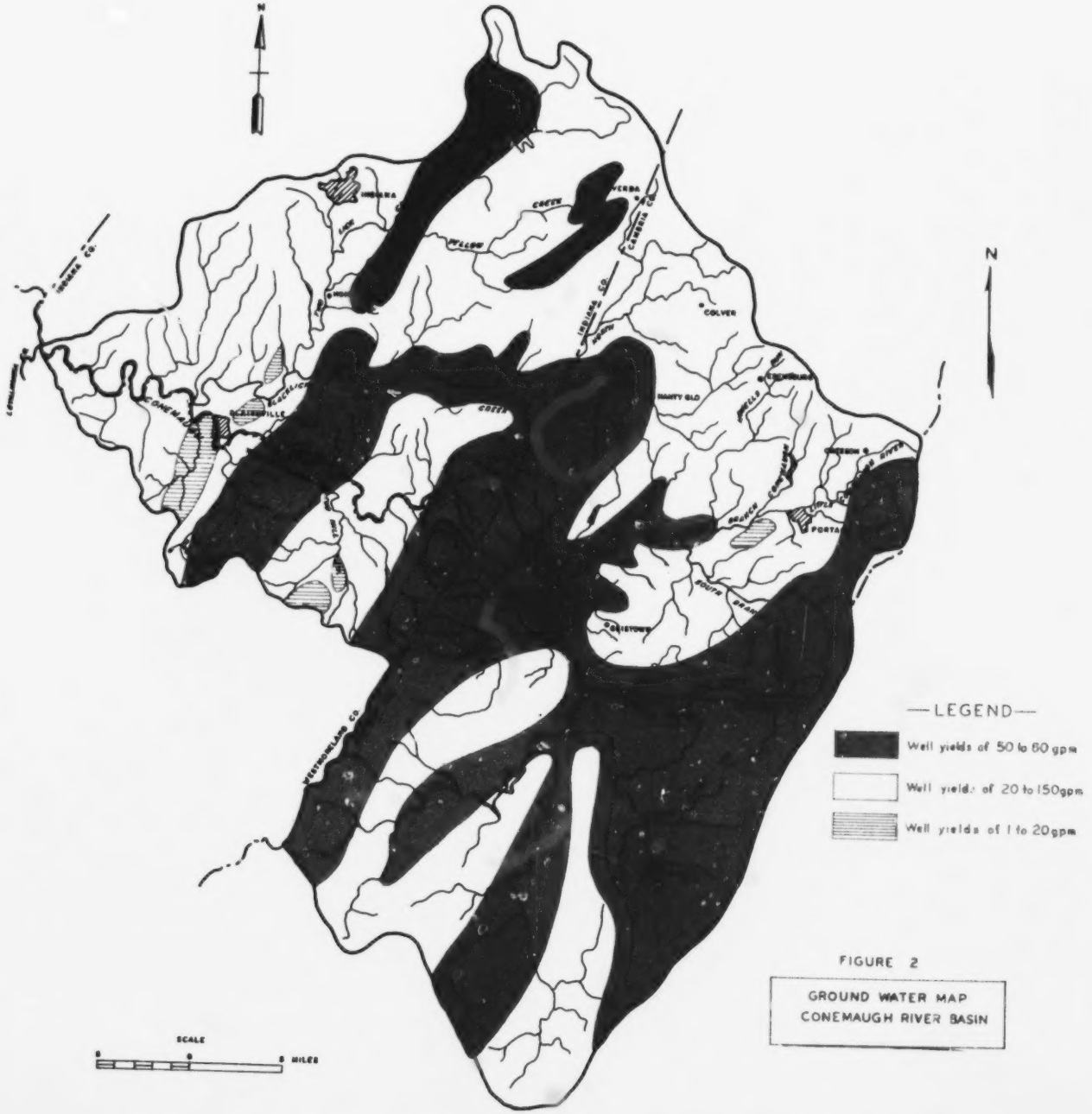


FIGURE 2

GROUND WATER MAP
CONEMAUGH RIVER BASIN

VI. ECONOMY

INTRODUCTION

The area of economic influence of the Conemaugh River basin project includes the counties of Cambria, Indiana and Somerset, Pennsylvania. An investigation of the population and economic characteristics and a projection of the probable growth of the area provides a basis for determining the water requirements in terms of quantity and quality.

PRESENT ECONOMY

The City of Johnstown is located in Cambria County and had a population of 53,949 in 1960. Johnstown exerts the primary economic forces on employment and population in the study area.

Total population in the study area declined from 378,270 to 356,099 between 1940 and 1960. In 1960 the study area represented 3.1 percent of the State population.

The urban population of the study area was 157,318 in 1960. This represented 44.2 percent of the total population. Rural population, farm and non-farm, was 198,781 in 1960, which showed a slight decline from 204,448 in 1950.

Mineral Resources

The mineral resources in the study area include coal, clay, sand, gravel, petroleum and natural gas. Bituminous coal is the most important in terms of value of output. Cambria County products the most mineral resources in the area.

Table 8 presents a summary of mineral production in the study area. The total value of minerals produced in the three counties represents about 10.6 percent of the total value for the State.

MANUFACTURING

In 1950, there were 26,284 persons employed in manufacturing. By 1960 employment had increased to 33,157. The largest increase occurred in fabricated metals and electrical equipment. Table 6 shows the distribution of manufacturing plants according to industry, class and size as measured by employment.

In 1963 there were 369 plants engaged in manufacturing. There were 37 plants with over 100 employees which included two plants with over 1,000 employees. A summary of manufacturing plants by counties is shown on the following page.

Summary of Manufacturing Plants by Counties

COUNTY	NO. PLANTS	No. OF PLANTS WITH MORE THAN 100 EMPLOYEES
Cambria	176	18
Indiana	77	14
Somerset	116	5

Lumber and wood products industry leads all manufacturing with 104 plants. As measured by number of employees, the most important industries are apparel and related products with four plants employing 500-999 and five plants with 250-499 employees. Primary metals was next with one plant employing over 1,000 and machinery except electrical with one plant employing over 1,000.

Table 7 summarizes the plants with high water intake by counties. Included are all plants which employed over 100 persons and whose four digit standard industrial classification code is included in the listing of industries with a water intake of more than 20 million gallons per year in the Industrial Water Survey, 1963, Census of Manufacturers.

Several U. S. highways transverse the area although the area lies in the mountainous terrain. The major east-west highways are U. S. Routes 22, 30 and 422; Interstate Routes 70 and 76; and the Pennsylvania Turnpike. The north-south highways include U. S. Routes 59, 119 and 219. Future highways planned for the area include the Appalachian Corridor M which will connect with Interstate 70 on the west and Altoona on the east. Also, Corridor N will connect with Interstate 70 on the south and Ebensburg to the north.

Rail facilities are mainly confined to the valleys serving the major population centers. The main rail line serving this area is the Baltimore and Ohio. There are no commercial airlines service or commercial navigation systems serving this area.

FUTURE ECONOMY

The projections of employment for the major industries were made by disaggregating the projections for the economic area made by the Office of Business Economics.

The study area projections include employment for major categories. In the case of individual counties, only population was projected. Urban area projections are based upon historical relationships between the urban area and the county and the county within which the urban area is contained. Table 9 shows the projected employment from 1960-2020. All categories show absolute increases except agriculture, forestry, fisheries and mining. Manufacturing remains the major employment category. Wholesale and retail trade and services are the second largest employment industries. Indices of gross output are shown in Table 11 for the major industries. Chemicals, fabricated metals and machinery show the highest percent increase by 2020. Table 10 shows the projected population for the counties in the study area. Total study area population is projected to increase by 27.8 percent from 356,099 in 1960 to 454,960 by 2020. The projections in this section have been used for calculating future water supply and water quality needs for this report.

VII. WATER SUPPLY

PRESENT WATER USE

Present water use and sources for the major municipalities in the basin are:

Municipality	County	Approximate Water Use (mgd)	Source of Supply
Johnstown	Cambria	11.5	Five Reservoirs
Nanty Glo	Cambria	0.65	Williams Run Reservoir
Ebensburg	Cambria	0.75	North Branch Little Conemaugh
Indiana	Indiana	1.9	Two Lick Creek
Blairsville	Indiana	0.48	Hillside Run Reservoir
Windber	Somerset	0.83	Clear Shade and Piney Run Reservoirs
Derry	Westmoreland	0.55	McGee Run and Millwood Run

The major water using industries in the basin, steel and power generation, obtain process water from their own systems. Smaller industries obtain their water from municipal or municipal-serving systems.

The two major electric generating plants in the basin, Homer City and Conemaugh Station, utilize cooling towers to conserve water. The Homer City plant has a large lake upstream to supply make-up water while the Conemaugh Station plant is situated on the main stem Conemaugh River.

The present water usage in gallons per capita per day (gpcd) varies from 80 to 120 depending upon the industrial demand and the percentage of meters installed.

FUTURE WATER SUPPLY NEEDS

Based on the projected economic data from Section VI, municipal and industrial water supply needs in the basin will be satisfied through 2020 by either present or planned facilities.

The supply problem in Indiana has been satisfied by the construction of the make-up water dam for the Homer City power plant, since make-up water releases to the power plant are via the existing stream bed. These same releases may also serve as an auxiliary source of supply for the community of Homer City.

The community of Derry is planning the construction of a pipeline from McGee Run to the existing Ethel Spring Reservoir to enhance the storage potential of the reservoir. The completion of a 100 percent metering program would probably assure an adequate supply for the community. The effects of metering in reducing water consumption can readily be seen by the following comparison. Peak water usage in Derry is almost as high as that in Windber with a population two and a half times that of Derry. Derry, however, is only one-third metered while Windber is completely metered.

The successful completion of a comprehensive mine drainage abatement program should make the main stem Conemaugh River an acceptable alternative water supply for Blairsville.

The several water companies and authorities serving the other communities in the basin appear to have done an excellent job of planning. Most of these suppliers have emergency taps into either (1) the other company lines or (2) industrial water supplies for use if needed.

Mining employment in 1960 was 9,837 which is about 15.0 percent of the State mining employment. From 1950 to 1960 there was a decrease of 18,709 persons employed in mining in the study area.

VIII. WATER QUALITY CONTROL

GENERAL

The waters of the Conemaugh River basin are natural resources upon which health and welfare, economic growth, recreation, fish and wildlife and the general aesthetics of the basin are dependent. The quality of the water resources of the basin has been reduced to a level which does not meet the requirements of the many would-be users, resulting in tangible economic losses in terms of limited economic growth and the virtual elimination of fishing and water-based recreation values.

Water quality may be adversely affected by domestic waste, industrial waste and natural sources of pollution. In the Conemaugh River basin, natural sources of pollution consist primarily of coal outcroppings. Industrial and domestic wastes are the primary sources of pollution in the basin.

Water quality in the basin may be greatly improved by providing mine drainage abatement and waste treatment facilities which will reduce or eliminate the concentrations of pollutants presently entering the streams. For the purpose of this study, secondary treatment providing substantially complete removal of all floatable and settleable materials, a minimum of 85 percent of BOD_5 and suspended solids based on design flow, and an equivalent degree of treatment of industrial waste was considered to provide adequate treatment for determination of needs for either additional treatment, low flow augmentation, or a combination of the above. It was found that under low flow conditions, the streams below ten communities in the basin could not assimilate the projected waste loads without lowering the dissolved oxygen to unacceptable values. The communities are Colver, Cresson, Derry, Ebensburg, Heilwood, Indiana, Jerome, Lilly, Portage and Windber.

The assimilative capacity of a stream is that capacity or ability of the stream to partially satisfy the BOD exerted by a bio-degradable waste discharge to the stream. The assimilative capacity is dependent upon the rate at which a waste degrades, the initial dissolved oxygen in the stream, the ability of the stream to replenish depleted dissolved oxygen by reaeration or photosynthesis and the concentration of BOD in the stream.

If, after providing secondary treatment, the assimilative capacity of the stream is exceeded, other quality control methods such as advanced waste treatment, stream aeration and flow augmentation need to be evaluated to determine what future methodology should be employed to protect the projected water uses in the basin.

PRESENT WASTE SOURCES

The major pollution problem in the Conemaugh basin is acid mine drainage with the resultant stream degradation extending the length of the Kiskiminetas River before neutralization finally occurs in the Allegheny River. A comprehensive remedial program in the basin should result in an overall reduction of seventy-five percent of the present acid load to Conemaugh Reservoir. Completion of the remedial program should restore many miles of stream to a condition allowing water based recreation to increase appreciably, even though the Conemaugh Reservoir would still be acidic. Figure 3, shows typical acid reductions that may be achieved by comprehensive remedial action.

Localized organic pollution problems exist below most of the communities in the basin at the present time. The construction and competent operation of secondary waste water treatment plants by the communities and an equivalent degree of treatment of industrial wastes will result in acceptable stream conditions below all but the ten communities listed previously. These communities, with the exception of Indiana, are so situated in the watershed that the construction of reservoirs for flow augmentation does not appear feasible. Alternative solutions are advanced waste treatment, piping of secondary treatment plant effluent to a point of greater streamflow, or a combination of these.

A large make-up water reservoir constructed upstream from Indiana for the Homer City Power Plant can supply sufficient flow for assimilation of secondary effluent below Indiana until the period 2000-2020, when some form of advanced waste treatment may be needed to maintain stream quality.

FUTURE WASTE ESTIMATES

Municipal and industrial waste projections for the study area were made utilizing data for estimated population and industrial growth presented in Chapter VI, The Economy. Major waste producing industries are in the fields of mining, basic metals and electric power production. Industrial waste projections were based on trends for industrial expansion and gross output in cases where other more specific information from the industries involved was not obtainable.

Sanitary waste projections were based on estimated population growth for water and sewer service areas. The projected waste loads and discharges to receiving streams for either major or critical areas for the years 1980, 2000 and 2020 are presented in Table 2.

ACID REDUCTIONS THAT MAY
BE ACHIEVED BY COMPREHENSIVE
REMEDIAL ACTION

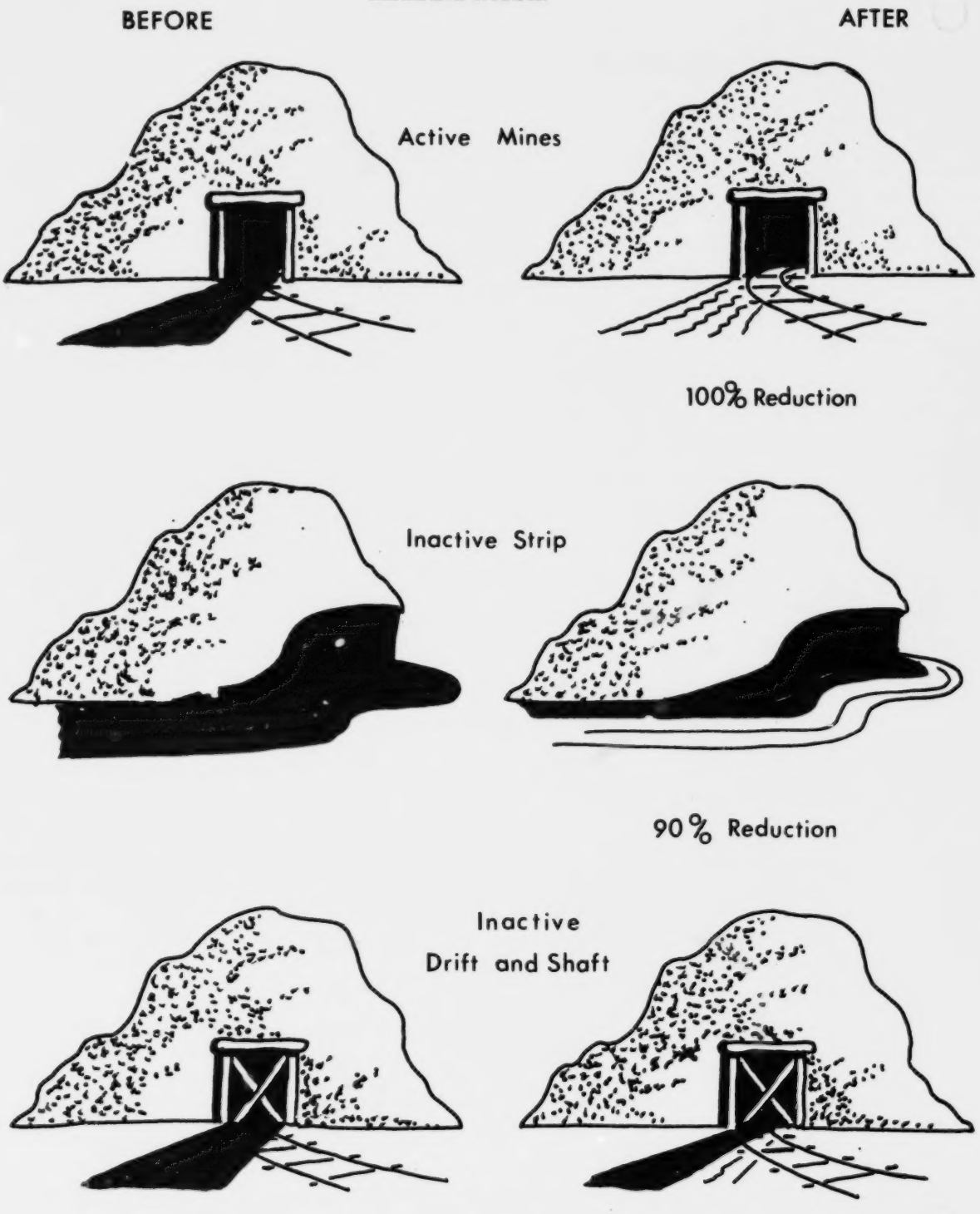


FIGURE 3

WATER QUALITY STANDARDS

In the absence of any published intrastate water quality standards for the Conemaugh basin, it was assumed for the purpose of this report that a minimum of 4.0 mg/l of D.O. and a maximum temperature of 30°C will be maintained in the stream below each community or industry. Water supply and recreational uses in the basin can be protected through disinfection of the wastes at their sources. Aquatic life can be promoted by elimination of toxic substances in industrial wastes and pH adjustment of discharges to a range of 7.0 to 9.0.

TABLE 2

PROJECTED WASTE LOADS FOR MAJOR AND/OR CRITICAL AREAS

COMMUNITY	RECEIVING STREAM	7 DAY-10 YR. LOW FLOW cfs	1980		2000		2020	
			LOAD (P.E.'s	FLOW cfs	LOAD (P.E.'s	FLOW cfs	LOAD (P.E.'s	FLOW cfs
Johnstown	Conemaugh River	150.	18,525	120.4	18,525	120.4	19,990	130
Colver	Trib. to Elk Creek	0.0	196	0.86	214	0.94	246	1.1
Cresson	Little Conemaugh Creek	0.0	414	1.8	452	2.0	519	2.3
Derry	McGee Run	0.0	514	2.3	655	2.9	770	3.4
Ebensburg	Heilles Run	0.0	1204	5.3	1385	6.1	1958	8.6
Heilwood	Yellow Creek	0.1	90	0.41	100	0.44	115	0.51
Indiana	Two Lick Creek	5.3*	3296	14.5	4010	17.6	5650	24.9
Jerome	Trib. to Quemahoning	0.0	192	0.8	204	0.9	229	1.0
Lilly	L. Conemaugh River	0.4	231	1.0	207	0.9	209	0.9
Portage	L. Conemaugh River	1.0	614	2.7	668	2.9	764	3.4
Windber	Paint Creek	0.6	1030	4.5	990	4.4	1050	4.6

*Power plant flow projections are 20 cfs in 1970; 15 cfs in 1980; 10 cfs in 2000 and beyond.

IX. BENEFITS

WATER SUPPLY

A negative annual benefit of $44,000, based on a reservoir life of 100 years, will accrue if the reservoir on Clear Shade Creek is constructed, since an existing water supply requiring only chlorination will be flooded and the new supply will require a filtration plant.

No water supply benefits were found to accrue from the reservoir on Stony Creek.

WATER QUALITY CONTROL

There is no need for additional water quality control flows below Stoystown, Kantner, Hooversville, Hollsopple, and the Johnstown complex, the communities affected by the proposed reservoirs. However, the proposed reservoirs will have a beneficial effect on Stony Creek and the Conemaugh River in regard to the acidity problem, although the effect will be minimal on Conemaugh Reservoir itself. The alkalinity to acidity ratio at the Clear Shade site is too low to have much beneficial effect. The ratio at the Stony Creek site is much higher, and would have a more pronounced effect on the acidity problem. No dollar value can be assigned to this benefit, as it is highly dependent on the degree of success of a comprehensive mine drainage abatement program. In the absence of a mine drainage abatement program, it was found that although this alkaline water would improve the present water quality, there would not be a sufficient change in quality to improve the usage made of it. Therefore, no benefit can be assigned to augmentation considered by itself.

APPENDIX A

MINE DRAINAGE

EVALUATION

OF

THE

UPPER CONEMAUGH RIVER BASIN

Stony Creek, Pennsylvania

Little Conemaugh River, Pennsylvania

Conemaugh River, Pennsylvania

Blacklick Creek, Pennsylvania

Two Lick Creek, Pennsylvania

Stony Creek Watershed, Pennsylvania

The headwaters of Stony Creek rise near Berlin, Pennsylvania and flow generally north through Somerset and Cambria Counties to its confluence with the Little Conemaugh River at Johnstown, Pennsylvania. A total of 466 square miles are contained within this drainage area. The principal tributaries to Stony Creek are Quemahoning Creek and Shade Creek with drainage areas of 99 square miles each.

Stony Creek and its two principal tributaries are affected in varying degrees by coal mine discharges over nearly their entire lengths. Shade Creek is seriously degraded by discharges in its headwaters areas. Due to additional large discharges downstream, natural stream recovery becomes impossible and the acid conditions persist at its mouth.

Quemahoning Creek above Sipesville is unaffected by mine drainage. Below this point, the creek receives numerous sources of pollutant discharges. Although Quemahoning Creek is degraded by mine drainage, it is probably the least affected portion of the watershed. A large privately-owned reservoir is located near the mouth of the creek which, after treatment, is used for industrial purposes.

The mainstem of Stony Creek is seriously degraded by mine drainage. This is particularly evident in the lower half of the watershed. The water quality of Stony Creek improves above Stoystown. Although numerous discharge points are located above this point, the cumulative effect is limited to localized degraded water quality. The upper portion of the watershed contains several streams which support varied forms of aquatic life, including stocked trout.

A total of 199 discharging sources were inventoried and sampled for chemical analysis in the Stony Creek watershed. The total measured discharge was 16,461 gpm or 23.7 million gallons per day emanating from coal mine sources. The total measured acid load was 48.7 tons per day. The largest single acid load was 13.4 tons per day from an abandoned drift mine. There were 13 additional sources which contributed acid loads exceeding 1000 lb/day.

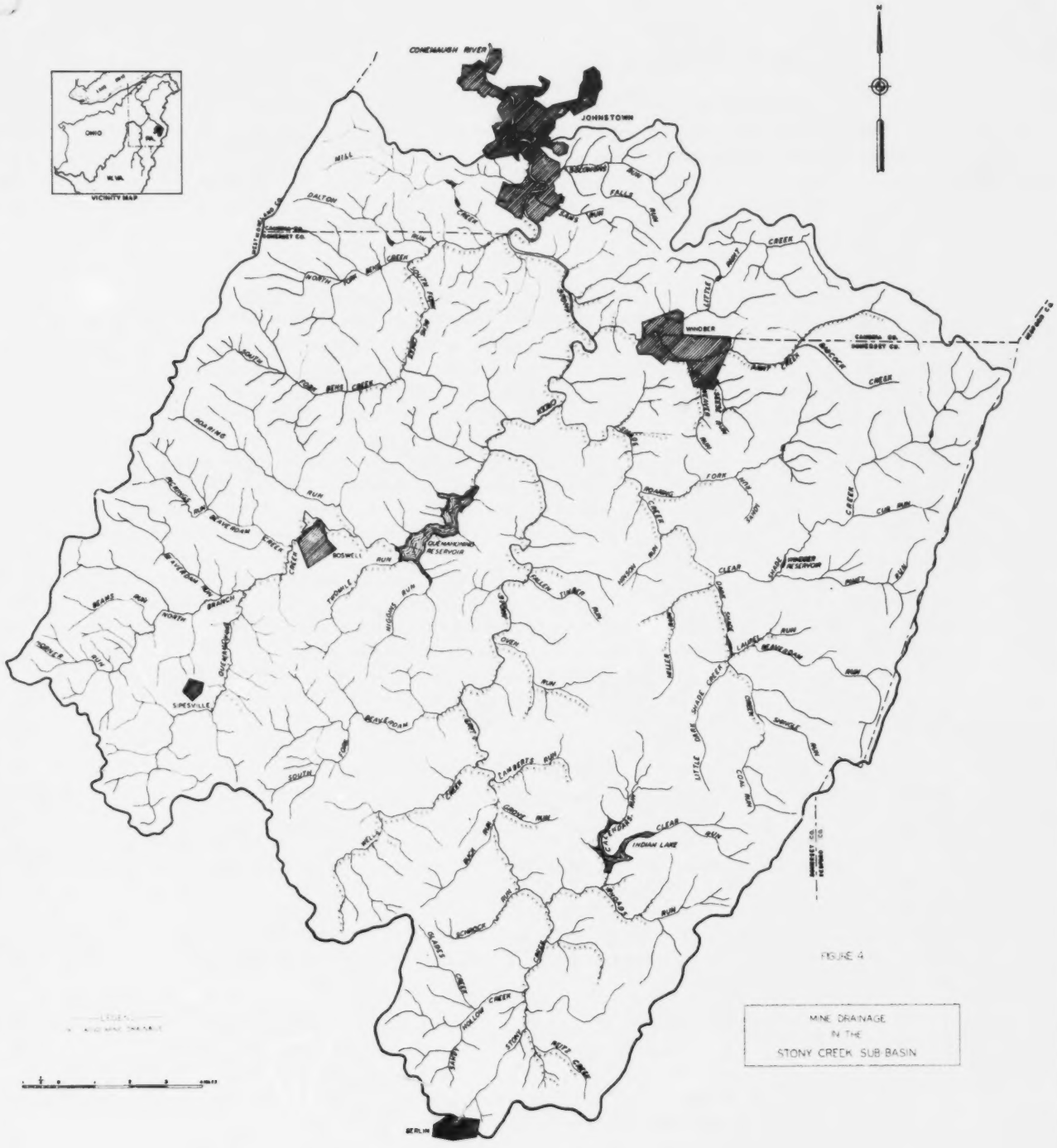
Abandoned drift mines were the major source of mine drainage in the Stony Creek watershed. Shaft mines and mine refuse piles were also major contributors. These three source types contributed a combined acid load of 84,145 lb/day, about 86 percent of the total source acid load discharged by all 199 sources.

Mine drainage loadings
by source type

Stony Creek watershed, Pennsylvania

Source Type	No.	Total Discharge (gpm)	Total Net Acidity (lb/day)
Drift Mines (inactive)	120	10,000	67,507
Strip Mines (inactive)	32	651	3,247
Combination Mines (inactive)	22	840	3,378
Shaft Mines (inactive)*	6	3,062	9,746
Mine Refuse Areas (inactive)	6	136	6,892
Drift Mines (active)	6	1,456	5,846
Strip Mines (active)	5	281	584
Coal Washery (active)	1	25	84
Tunnel	1	10	26
TOTALS	199	16,461	97,310

*Includes slope mines and borehole discharges.


CONEMAUGH RIVER
JOHNSTOWN
VICINITY MAP
OHIO
DALTON
MILL CREEK
NORTH FORK BEAVE CREEK
SOUTH FORK BEAVE CREEK
WHOBER
ROARING RUN
ROARING FORK CREEK
LITTLE PICKING RUN
BEAVE ROAN STREET
BEAVERDAM BRANCH
BEARS RUN
NORTH FORK
SOUTH FORK
ROSWELL RUN
TROUTS RUN
HIDDEN RUN
OLE MANCHANNO RESERVOIR
SIPESVILLE
BEAVERDAM RUN
FALLEN TIMBER RUN
OVEN RUN
LITTLE PICKING CREEK
LAUREL RUN
CLEAR SHADE CREEK
INDIAN LAKE
CLEAR RUN
CUB RUN
PINEY RUN
SHADE RUN
SHOCK RUN
COAL RUN
TAMARACK RUN
GROUSE RUN
BIG RUN
ELKS RUN
BLACKLICK CREEK
STONY CREEK
HOLLOW CREEK
BERLIN
FIGURE 4
MINE DRAINAGE
IN THE
STONY CREEK SUB BASIN

Little Conemaugh River, Pennsylvania

The headwaters of the Little Conemaugh River rise near Cresson, Pennsylvania and flow generally west through Cambria County to its confluence with Stony Creek in the city of Johnstown, Pennsylvania. South Fork is the principal tributary to the Little Conemaugh River and drains 62 square miles of the total 188 square mile drainage area.

The headwaters of the river are affected by mine discharges immediately south of the community of Cresson. The discharge volume of these sources is small, however the effect upon the headwaters is a pH reduction to about 4.5 to 5.0. In the general area of Portage, Pennsylvania, the Little Conemaugh River receives massive amounts of mine drainage from abandoned shaft mine boreholes. Three such boreholes in this area discharged a measured flow of 5750 gpm and carried an acid load of 19 tons per day to the Little Conemaugh River. Trout Run, tributary to the Little Conemaugh, is a highly acid stream due to the borehole discharge of the Miller shaft mine. This discharge carried an acid load of 5.7 tons per day.

The water quality of the South Fork is unaffected by mine drainage above the community of Beaverdale. However, a borehole at Beaverdale results in continual downstream acid pollution of the South Fork. Below this point, three additional major discharges were located. The largest of these resulted from the St. Michael shaft. At this point, an acid load of about 24 tons per day was discharged to the South Fork of the Little Conemaugh River.

During a 1966 stream sampling program, the Little Conemaugh River below the confluence of South Fork carried a maximum acid load of 55.5 tons per day.

Between the communities of South Fork and Johnstown, numerous discharges contribute additional acid loads to the river. Several boreholes near Saltlick Reservoir and discharges on Clapboard Run carry high acid loads. The Little Conemaugh River was sampled and flow measurements obtained at the U. S. Geological Survey gaging station near the mouth of the river.

A total of 99 discharging sources were inventoried in the Little Conemaugh River drainage area. The total measured discharge volume was 20,433 gpm or more than 29 million gallons per day. The total source acid load was 76.8 tons per day. Active mines contributed only one ton per day of acidity.

Mine drainage loadings
by source type

Little Conemaugh River, Pennsylvania

Source Type	No.	Total Discharge (gpm)	Total Net Acidity (lb/day)
Drift Mines (inactive)	43	4,651	32,085
Strip Mines (inactive)	18	436	2,142
Shaft Mines (inactive)	12	14,293	109,451
Combination Mines (inactive)	6	352	1,941
Mine Refuse Areas	14	262	6,352
Coal Crop	1	5	-1
Strip Mine (active)	2	22	326
Drift Mines (active)	2	367	1,423
Oil Well	1	45	-149
TOTALS	99	20,433	153,570

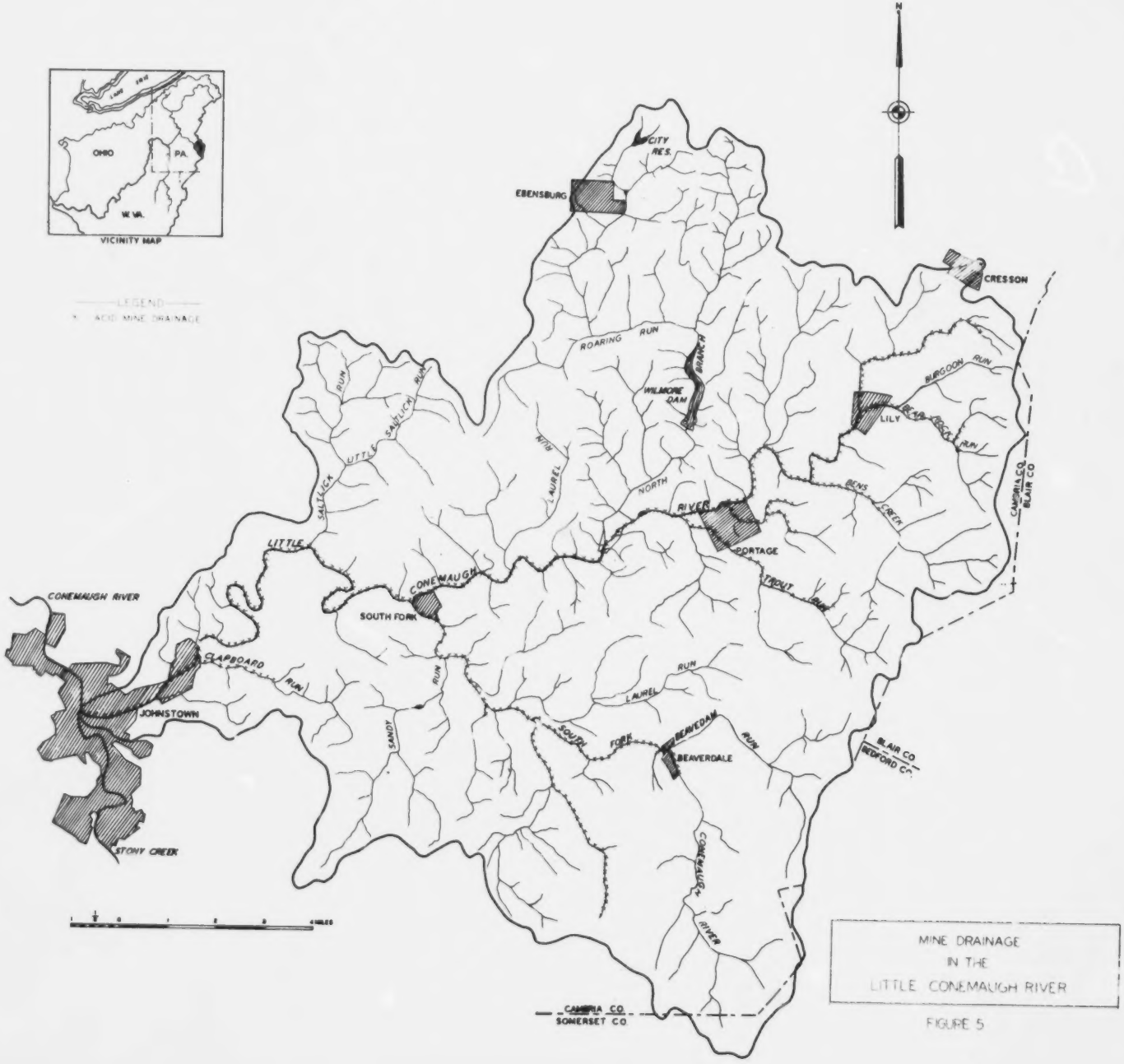

VICINITY MAP
OHIO
PA.
W. VA.
LEGEND
ACID MINE DRAINAGE
N
CITY RES.
EBENSBURG
CRESSON
ROARING RUN
BRANCH
WILMORE DAM
BIRGOON RUN
LILY
PEGGS RUN
BENS CREEK
CAMBRIA CO.
BLAIR CO.
NORTH
RIVER
PORTAGE
TROUT RUN
LITTLE
CONEMAUGH
CONEMAUGH RIVER
SOUTH FORK
SLAPPOARD RUN
JOHNSTOWN
STONY CREEK
SANDY RUN
LAUREL RUN
SOUTH FORK
BEAVERDAM RUN
BEAVERDALE
BLAIR CO.
BEDFORD CO.
CONEMAUGH RIVER
CAMBRIA CO.
SOMERSET CO.
MINE DRAINAGE
IN THE
LITTLE CONEMAUGH RIVER

FIGURE 5

Conemaugh River, Pennsylvania

The Conemaugh River is formed by the confluence of the Little Conemaugh River and Stony Creek at Johnstown, Pennsylvania. From this point, the river flows northwest to its confluence with Loyalhanna Creek at Saltsburg, Pennsylvania. Due to the grossly polluted acid condition of both the Little Conemaugh River and Stony Creek, and additional acid discharges received by the mainstem, the Conemaugh River is severely polluted by coal mine drainage over its entire length.

Abandoned underground mines are the principal acid-contributing sources to the mainstem of the Conemaugh River. Twenty-five such discharging sites were examined. Their combined acid load was more than 13 tons per day, approximately 75 percent of the total load measured in this drainage area. The largest acid load encountered in the watershed was 8.8 tons per day from an abandoned underground mine draining directly to the river. There were five additional sources discharging acid loads in excess of 1,000 lb/day. Six refuse areas examined during the survey discharged a total of 3.3 tons per day of acidity.

A total of 36 discharging sources were sampled for chemical analysis along the mainstem Conemaugh River. The total measured discharge volume was 3,045 gpm, or 4.3 million gallons per day, emanating from coal mine sources. The total source acid load was 17.5 tons per day. Only one active mine was inventoried, however, its discharge was alkaline.

Mine drainage loadings
by source type
Main Stem of the Conemaugh River, Pennsylvania

Source Type	No.	Total Discharge (gpm)	Total Net Acidity (lb/day)
Drift Mines (inactive)	23	2427	22,890
Shaft Mine (inactive)	1	300	3,546
Strip Mines (inactive)	4	95	1,734
Combination Drift Mines (inactive)	1	5	162
Mine Refuse Areas	6	214	6,780
Drift Mines (active)	1	4	-8
TOTALS	36	3045	35,104

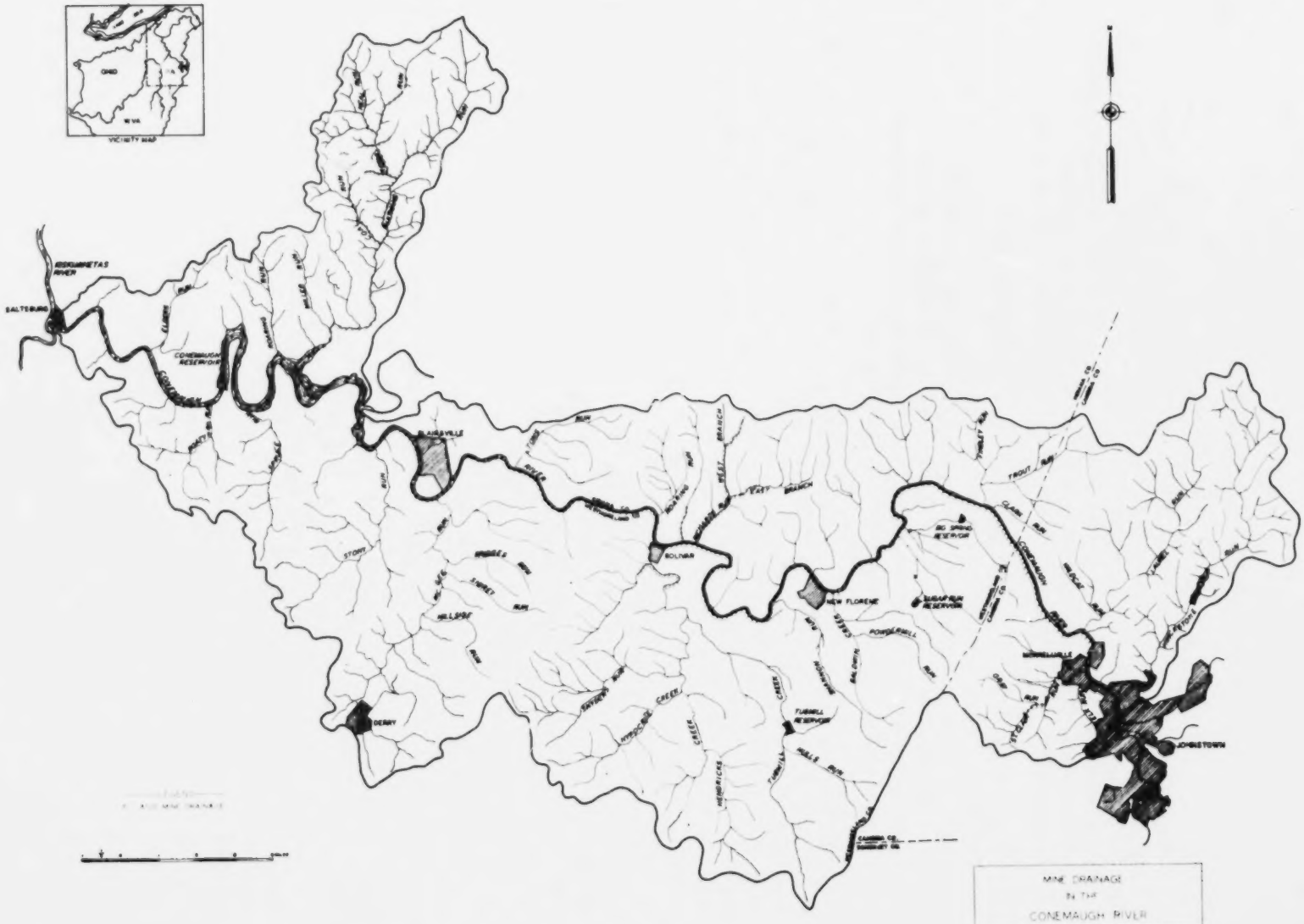

VICINITY MAP
KISKIMINETAS RIVER
SALTSBURG
CONEMAUGH RIVER RESERVOIR
CONEMAUGH RIVER
LOYALHANNA CREEK
BLACKLICK CREEK
STONY CREEK
STONYCREEK RIVER
LITTLE CONEMAUGH RIVER
SOUTH FORK
SOUTH FORK RESERVOIR
QUEMAHONING CREEK
PAINT CREEK
SHADE CREEK
ROARING CREEK
CLEAR SHADE CREEK
WHITE OAK RUN
SPRUCE RUN
SHOEMAKER RUN
BEAVER RUN
SHERMAN RUN
HILLSIDE RUN
SWANK RUN
SCHOOL RUN
BOLIVAR
NEW FLORENCE
DERRY
JOHNSTOWN
CAMBRIA CO.
INDIANA CO.
MINE DRAINAGE
IN THE
CONEMAUGH RIVER

FIGURE 6

Blacklick Creek Watershed, Pennsylvania

Blacklick Creek (less Two Lick Creek, its principal tributary) drains 222 square miles of southern Indiana and central Cambria Counties, Pennsylvania. Its major tributaries are the North and South Branches which join near Vintondale, Pennsylvania to form Blacklick Creek. From Vintondale, the creek flows west to its confluence with the Conemaugh River near Blairsville, Pennsylvania.

Large active slope and shaft mine discharges, located on both the North and South Branches of Blacklick Creek, are primarily responsible for the severely degraded water quality of Blacklick Creek at Vintondale. The active mines located in this portion of the drainage area discharged nearly 17,000 gpm to watershed streams and carried an acid load exceeding 65 tons per day.

During the study period, refuse areas were found to be major sources of acid discharges. Twenty-two such sites were examined and sampled. The total acid load from these refuse areas was 23.6 tons per day. Near the community of Nanty Glo, a small tributary which is in continual contact with a large refuse pile, carried an acid load of 17.7 tons per day to the South Branch of Blacklick Creek.

Below Vintondale, significant acid loads are received by Blacklick Creek over its entire length. Inactive drift mines discharged an acidity loading of 30 tons per day and abandoned shaft mines contributed an additional 5.5 tons per day. Only two active mines discharged significant acid loads in this lower portion of the watershed.

A total of 161 discharging sources were inventoried in the Blacklick Creek drainage area (excluding Two Lick Creek). The total measured discharge volume was 25,196 gpm or 36.3 million gallons per day. The total source acid load was 136.5 tons per day. Active mines contributed approximately 50 percent of this total acid load.

During the 1966 stream survey, Blacklick Creek above Two Lick Creek carried an acidity loading which ranged from 0.17 to 1.2 million lb/day. The pH value remained below 3.0 during the sampling period. Acidity concentrations as high as 897 mg/l were recorded at this same point.

Mine drainage loadings
by source type
Blacklick Creek watershed, Pennsylvania

Source Type	No.	Total Discharge (gpm)	Total Net Acidity (lb/day)
Drift Mines (inactive)	54	3,710	61,246
Strip Mines (inactive)	42	1,132	5,448
Mine Refuse Areas	22	852	47,103
Combination Mines (inactive)	27	1,053	13,501
Shaft Mines (inactive)	2	1,022	11,326
Shaft Mines (active)*	9	16,696	130,747
Drift Mines (active)	5	731	3,702
TOTALS**	161	25,196	273,073

* Includes slope mines and borehole discharges.

**Parameter loadings reflect conditions measured during the 1968 survey. The active mine contribution has been significantly reduced since this date due to the installation of treatment facilities.

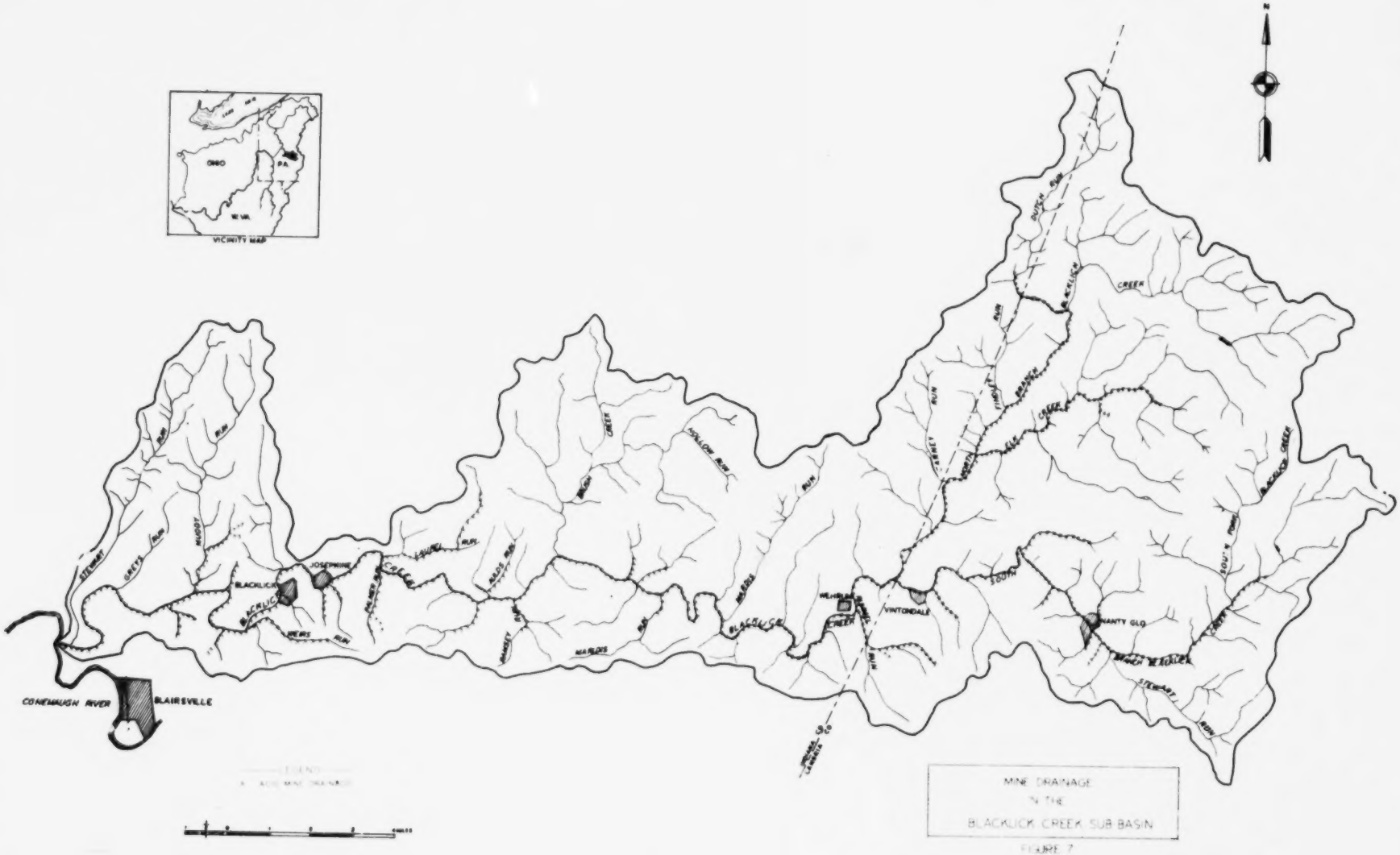

VICINITY MAP
OHIO
PA.
W. VA.
CONEMAUGH RIVER
BLAIRSVILLE
BLACKLICK
JOSEPHINE
VINTONDALE
SOUTH
BLACKLICK CREEK
STEWART
RUN
CREEK
MINE DRAINAGE
IN THE
BLACKLICK CREEK SUB BASIN

FIGURE 7

Two Lick Creek Watershed, Pennsylvania

The headwaters of Two Lick Creek rise in east-central Indiana County, Pennsylvania, and flow southeast through the county to its confluence with Blacklick Creek near Blacklick, Pennsylvania. Yellow Creek is the principal tributary and drains 67 square miles of the total 190 square mile drainage area.

Two Lick Creek is formed by the junction of the North and South branches. The north branch is degraded by mine drainage in its headwaters area and, due to numerous downstream discharges, natural stream recovery is impossible. No evidence of mining activity was found on the South branch and its waters support numerous types of aquatic life.

Twelve discharge points were found that carried acid loads exceeding 500 lb/day to Two Lick Creek. The highest acid load, four tons per day, resulted from an abandoned shaft mine. During the mine drainage source investigation, stream sampling and attendant flow measurements were obtained at fifteen points in the Two Lick Creek watershed.

Yellow Creek, principal tributary to Two Lick Creek, is not adversely affected by mine drainage above the Homer City water supply reservoir. Several minor discharge points were found above the reservoir; however, they cause no serious water quality problems and downstream recovery is rapid. A large mine dump from an active mine is located on the bank of Yellow Creek. Drainage from this dump nd others in the immediate area are largely responsible for the noticeable discoloration of Yellow Creek. An acid load of 936 lb/day from a combination mine was the highest load encountered in the Yellow Creek drainage area.

A total of 174 discharging sources were inventoried and sampled for chemical analysis in the Two Lick Creek watershed. The total measured discharge volume was 7,102 gpm or 10.2 million gallons per day. The total source acid load was 18.3 tons per day. Active mines inventoried during the survey contributed a daily acidity loading of -508 lb/day.

Mine drainage loadings
by source type
Two Lick Creek watershed, Pennsylvania

Source Type	No.	Total Discharge (gpm)	Total Net Acidity (lb/day)
Drift Mines (inactive)	71	4,280	15,504
Strip Mines (inactive)	42	778	2,607
Mine Refuse Areas	20	296	7,195
Shaft Mines* (inactive)	2	350	8,117
Combination Mines (inactive)	28	715	3,676
Coal Outcrop	2	98	44
Gas Wells (abandoned)	2	22	11
Drift Mines (active)	6	562	-508
Strip Mines (active)	1	1	-1
TOTALS	174	7,102	36,645

*Includes slope mines and borehole discharges.

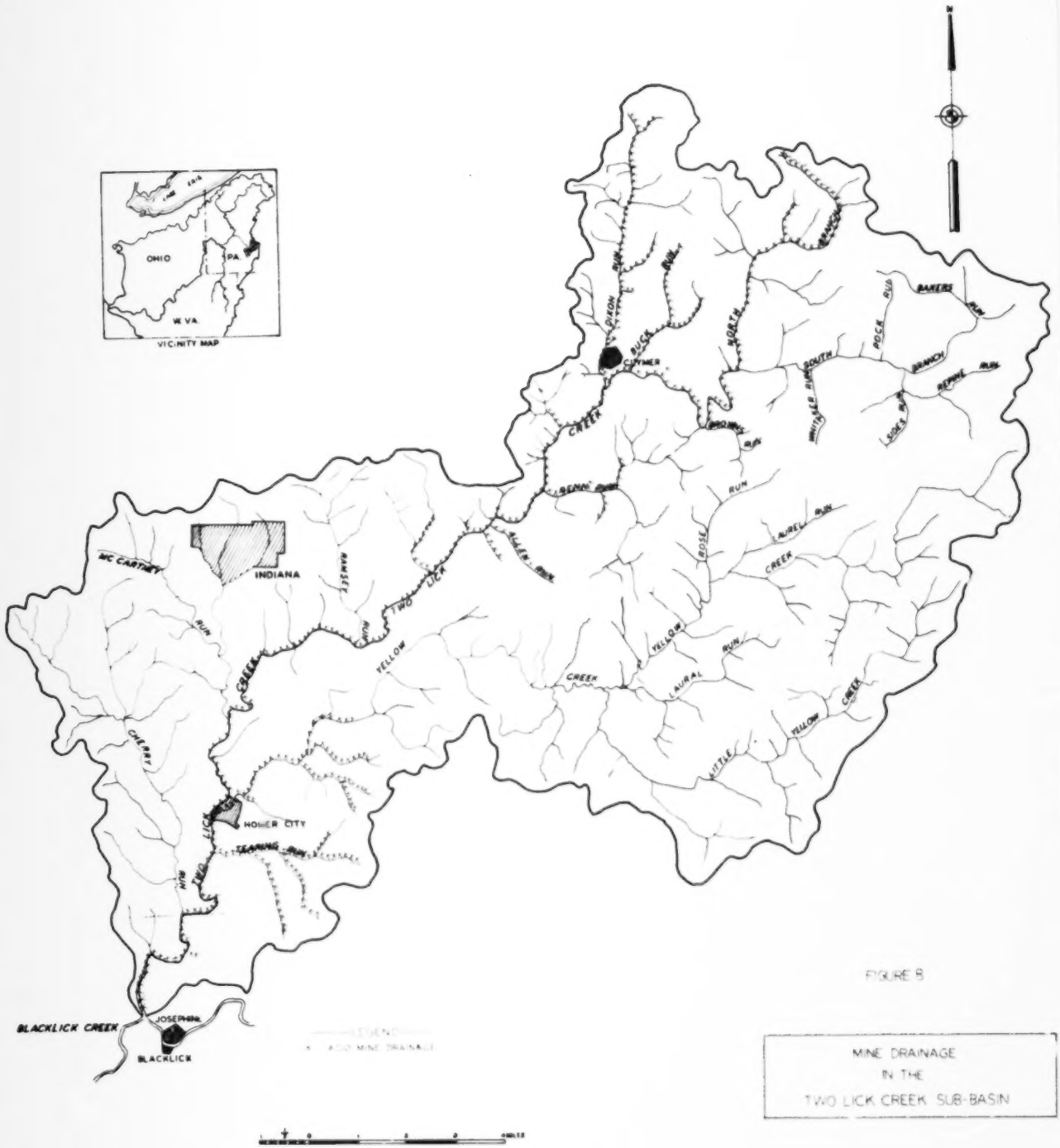


FIGURE 8

LEGEND
ACID MINE DRAINAGE

MINE DRAINAGE
IN THE
TWO LICK CREEK SUB-BASIN

TABLE 3

Upper Conemaugh River

Watershed Acid Loading

Tributary*	(lbs/day) Acid Load (1966 Survey)**	Drainage Area (Sq. Mi.)***	Acid Load (lbs/day) (Sq. Mi.)
Conemaugh River (above Reservoir)	794,500	800	993
Blacklick Creek	416,098	412	1009
Two Lick Creek	76,225	190	401
Shade Creek	26,099	98	266
Dark Shade Creek	23,240	32	726
Tub Mill Creek	3,254	66	49
Quemahoning Creek	428	99	4

*Sampled near mouths unless otherwise indicated.

**Net Acidity (Acid Load - Alkaline Load).

***Drainage area above the sampling point.

APPENDIX B

BIOLOGICAL DATA

SUMMARY

I. INTRODUCTION

Objectives and Scope of Biological Study

The Wheeling Field Office, EPA, Region III, conducted a water quality study of the Allegheny River basin during 1966 and 1967. The Wheeling Office performed physical, chemical and biological analyses and observations throughout the drainage area. This section deals with the biological studies conducted in the Conemaugh River basin as a part of the Allegheny investigation.

The objectives of the biological study are (1) to define the aspects of pollution prior to intensive chemical appraisal of the water quality and (2) to establish a baseline of present biological conditions against which future changes can be measured.

The aquatic biology survey provides an analysis of the water quality in a given stream or section of stream. The biological data and descriptions delineate the areas capable of supporting aquatic organism associations typical of non-polluted water as opposed to those aquatic communities exhibiting a disrupted or altered biota. An altered community indicates environmental changes such as occurs with pollution of the habitat.

The results of this survey and related observations, together with other basic information, constitute a base for the planning, formation and execution of water quality surveys incorporating other scientific and engineering disciplines.

The effects of pollution on aquatic life can be dramatic, as for example, the occurrence of a fish kill. The effects can also be demonstrated in more subtle ways. The effects of pollution on organisms have been presented with the use of different techniques and demonstrations by aquatic biologists in numerous water pollution reports. The use of biological phenomena in assessing water quality is an established and accepted methodology employed by water pollution investigating agencies.

The Conemaugh River basin major pollution problems are the result of extractive and manufacturing industries. Oil production has produced pollution by brines and other oil field wastes. Long years of coal mining have left a number of streams contaminated by mine drainage containing sulfuric acid-iron wastes. A major portion of this acid load occurs in the Blacklick drainage.

II. SUMMARY OF FINDINGS

Benthological analyses were made on twelve individual square foot samples from ten locations in the Conemaugh River basin.

The benthic organisms collected and observed during the study reflected the effects of the major sources of pollution in the Conemaugh River basin. Mine drainage pollution was considered to be the most prevalent and damaging environmental stress on aquatic life in the basin. The benthic faunae of the Conemaugh River basin reflected severe mine drainage pollution effects.

The synoptic biological survey delineated streams or sections of streams in the Conemaugh River basin that were affected by some type of pollution. The survey was not an in-depth detailed study of individual species response to specific pollutants. It was not designed as such. The study did provide an appraisal on which intensive water quality studies were planned and executed. It recorded certain physical characteristics such as bottom sediments, which are often disregarded in pollution studies. The study also established a baseline of present conditions which can be compared to future, more intensive biological studies.

The following flow chart gives a graphic presentation of the percentage composition of benthic samples found during the 1966-1967 survey. It may be seen from the chart that Class I Tolerance organisms were found at only one location in the Blacklick Creek watershed; an indication of gross pollution in the watershed.

III. METHODS AND TECHNIQUES

Benthos Role in Water Pollution Surveys

The primary objective of a biological survey as part of the comprehensive project is to determine the water quality using aquatic organisms as an index. The role of benthic organisms in the study of water pollution has been well documented.

The biological characterizations of any given stream are readily accomplished by a study of the macro-invertebrate fauna. The aquatic community includes three major groups: the nekton or free swimmers, the plankton or drifters, and the benthos or bottom associated organisms. Since fish are transient in nature

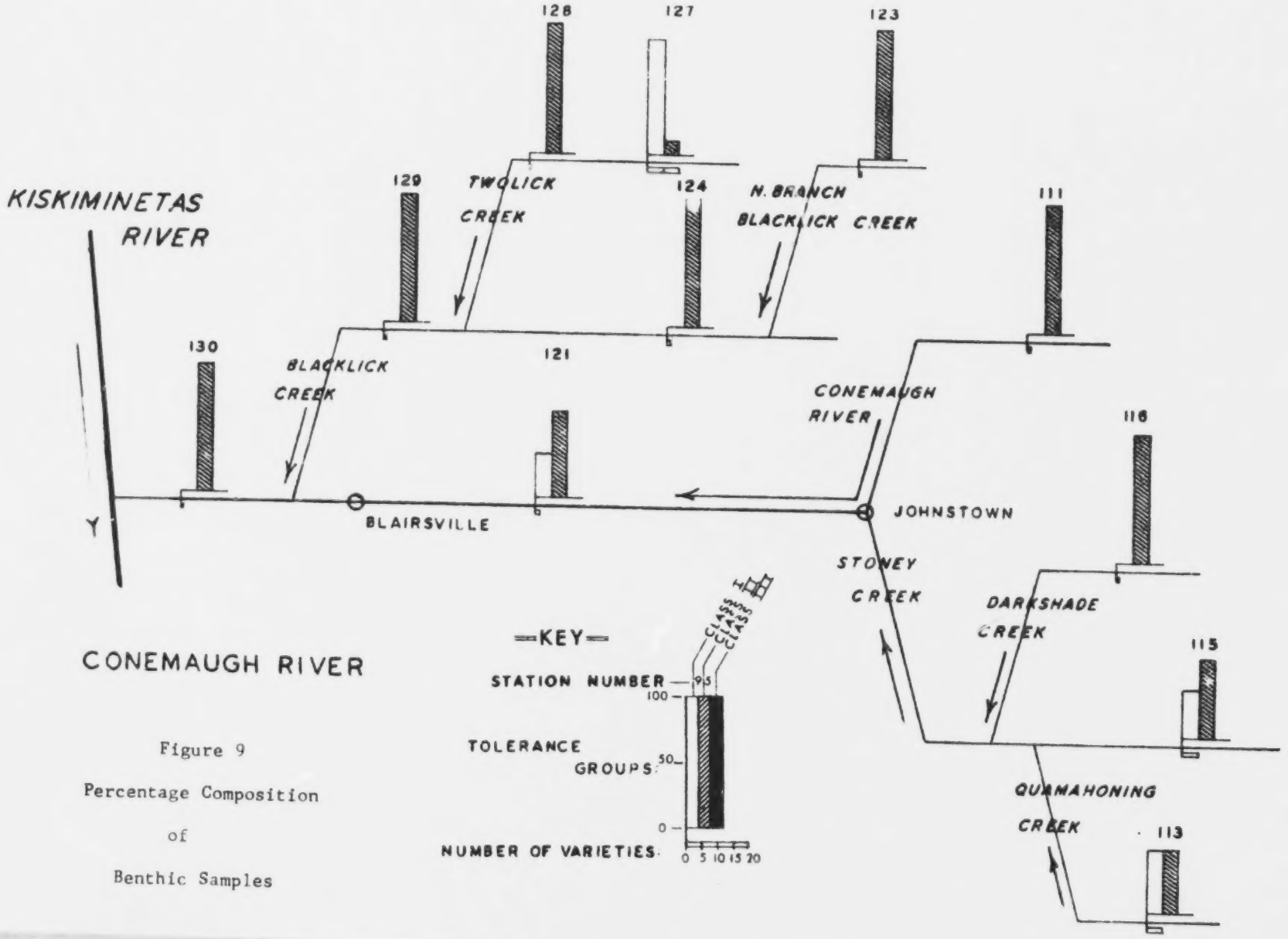


Figure 9

Percentage Composition

of

Benthic Samples

and plankton are moved about by currents, the benthos is best suited for study to determine prevailing water quality conditions. Bottom dwelling organisms exhibit a pronounced response to pollution, have a sufficiently long life cycle to prevent response to intermittent relief from pollution, and lack a means of rapid locomotion thus prohibiting extended migrations. Because of these qualities, bottom-dwelling organisms reflect conditions at the sampling point for an extended period of time.

Field and Laboratory Techniques

Whenever possible, samples are collected from riffle areas. It has been demonstrated that the degree and extent of pollution in a stream can be determined accurately by reference to the macro-invertebrate fauna, particularly that found in the riffles. Also, particulate organic matter and silt tend to settle out in pools creating an unfavorable habitat. Samples collected from such areas do not often reflect the true condition of the stream.

The number of samples collected at any one station is left to the judgment of the biologist. Generally, two to three cross section samples per station (or sample site) are collected, depending on the size of the stream. Published reports have shown that only two square-foot samples are necessary to be reasonably certain of obtaining representatives of the principal groups of organisms present.

The material collected is washed, sieved (when collected with a dredge), and placed in quart jars with preservative. The samples are transported to the station laboratory for enumeration and identification of the aquatic organisms. All organisms are identified to the family toxonomic level, with the exception of the sludge worms which are identified only to the class taxonomic level. The individual groups of organisms are classed as sensitive, tolerant and very tolerant based upon their response to pollution. This classification is based on known tolerances of various groups as reported in the literature, and upon personal observations of various benthic associations encountered in both polluted and unpolluted waters.

IV. RESULTS OF BENTHIC SAMPLING

A total of 19 stations were established and studied throughout the Conemaugh River basin. Table 4 lists the location and physical description of each station. Figure shows the station locations of quantitative samples collected

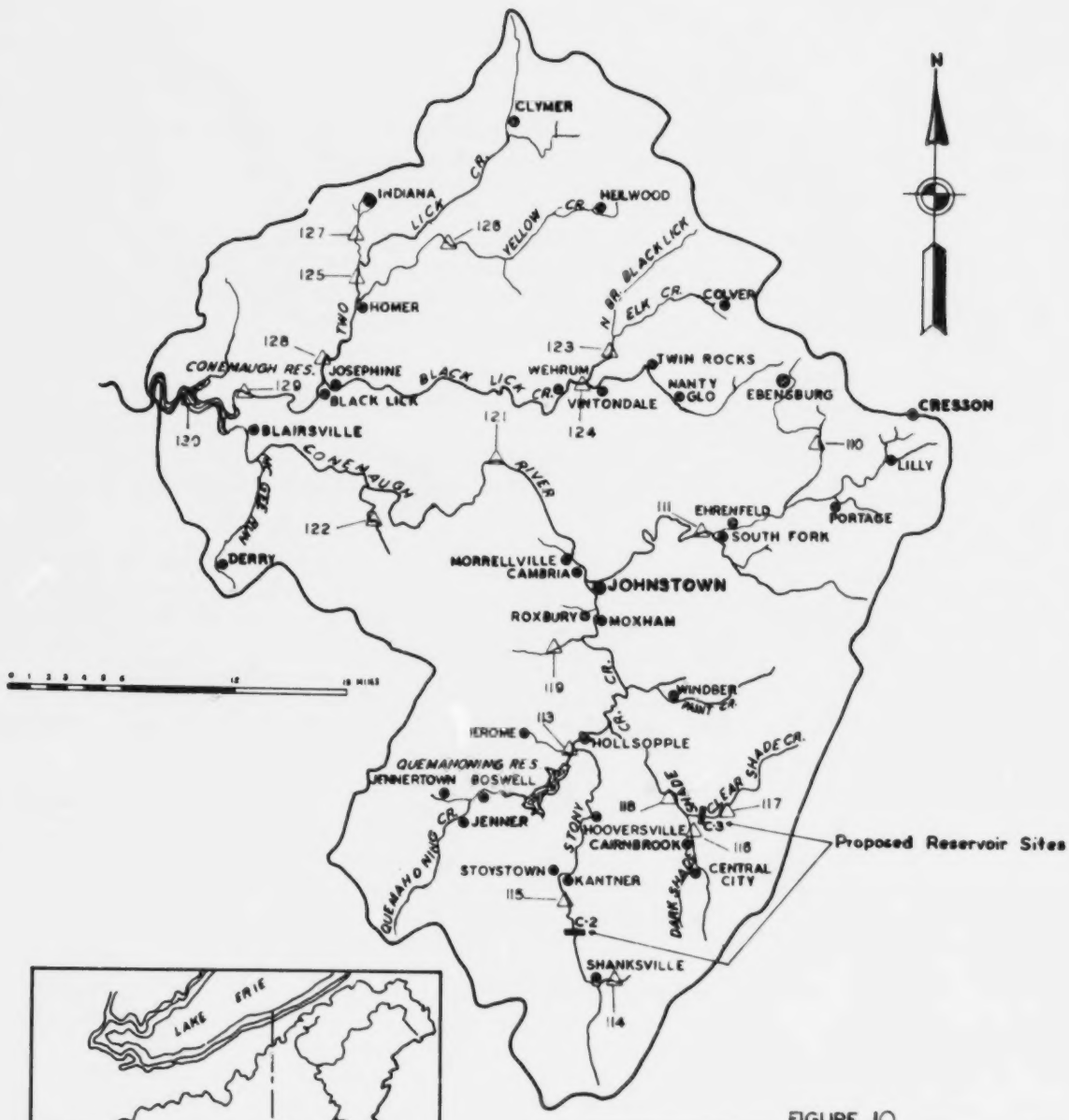


FIGURE 10

UPPER CONEMAUGH RIVER BASIN

BIOLOGICAL SAMPLING STATION LOCATIONS

during the study. Quantitative benthic samples were collected at ten stations and qualitative examinations were made at nine stations.

The physical composition of the substrate and habitat available, as described in Table 4 affects the number and kinds of organisms present. A knowledge of the habitat normally occupied by various organisms and the effect of habitat changes upon these organisms are as important as the direct effects of water quality changes. Recognition of this ecological principal is most important to the conclusions developed in the evaluation for a particular section of stream. The benthic association observed and the habitat analysis must both be given equal consideration when evaluating the pollutional status of a given area.

Table 5 lists the macroinvertebrate composition of each station sampled. The table includes the stream, station number, number of square foot samples collected, number of individuals for each taxonomic group collected, total number of organisms collected, average number per square foot, number of varieties, and percentages of pollution tolerance groups. These percentages were based on the number of individuals occurring in each tolerance group.

The pollution tolerance groups, for demonstration purposes, are called Class I, II and III. The tolerance groups, as defined for this document, are: I) sensitive, or organisms unable to withstand polluted conditions; II) tolerant, or organisms capable of withstanding moderate amounts of pollution, and III) very tolerant, or organisms with the capability to withstand severe polluted conditions. Classes II and III have a wide range of tolerance levels, and with increased pollution these groups are able to replace the sensitive forms in the biota.

The variety diversity and percentages of the tolerance groups are represented in the preceding flow-chart by bar graphs and histograms respectively. These graphic figures are shown for each of the sampled stations on schematic drawings of the Conemaugh River and its tributaries. It is noted that a reduction in the number of varieties generally is accompanied by an increase in the percentage of tolerant and very tolerant forms.

The findings of the benthological studies are discussed for each of the major drainages in the Conemaugh River basin. The majority of the sampling was characterized by benthic faunae tolerant of mine drainage pollution. Only four of the 19 locations were considered to be unaffected by this type of pollution.

The benthic samples collected in the Conemaugh River (Stations 111 and 121), consisted of a few tolerant organisms and a reduced number of varieties. All of the Conemaugh River locations exhibited physical evidence of mine drainage pollution.

The benthos of Quemahoning Creek (Station 113), a tributary of Stony Creek, consisted of a few varieties which were equally distributed among the sensitive and tolerant forms. There was physical evidence of both organic and mine drainage pollution observed at this sampling location.

The benthic composition of Stony Creek (Station 115) consisted of a few varieties which was predominated by the tolerant forms. No evidence of pollution was observed at the sampling location.

The samples collected from Dark Shade Creek (Station 116), a tributary of Stony Creek, yielded a few organisms all of which were tolerant forms. Mine drainage pollution was observed at the sampling location. Qualitative examination of the benthos of Dark Shade Creek at Hillsboro (Station 118), Pennsylvania produced no benthic organism and similar mine drainage pollution conditions existed.

With the exception of one sampling station, all the locations sampled in the Blacklick Creek drainage were affected by mine drainage pollution. The benthic composition from the North Branch of Blacklick Creek (Station 123), Twolick Creek (Station 128), and Blacklick Creek (Stations 124 and 129) consisted of a few organisms and varieties which were predominately tolerant forms. The lone exception to these conditions was observed on Ramsey Run (Station 127), a small tributary of Twolick Creek. The benthos sampled here consisted of several varieties predominated by the sensitive forms.

V. GENERAL DISCUSSION OF FISH LIFE

The Allegheny River basin is the home of a variety of freshwater fishes and is noted for its excellent sport fishing. Smallmouth bass, walleye, muskellunges, northern pike, trout and catfish are desirable sport fishes frequently caught in the basin. Many of the headwater tributaries of the Allegheny contain or contained at one time, the native brook trout. Several of these streams are presently stocked with hatchery reared brook, rainbow and brown trout.

Mine drainage pollution has severely reduced and in some cases eliminated fish life in many of the streams in the Conemaugh basin. The influence of the mine drainage pollution from the basin has been severely damaging to the lower Allegheny River. Frequent fish kills in the Allegheny have been attributed to the flowage from the Kiskiminetas, as can be seen from the following list.

Selected Allegheny River Basin Fish Kills, 1965-1967

STREAM	LOCATION	DATE OF KILL	OPERATIONS INDICATED AS RESPONSIBLE FOR KILL	ESTIMATED NUMBER OF FISH KILLED
Howells Run	Ebensburg, Pa.	3/2/66	Transportation	1,000
Stony Creek	Shanksville, Pa.	5/2/66	Mining	57
Allegheny River	Oakmont, Pa.	8/3/66	Mining	5,000
Allegheny River	Sharpsburg, Pa.	8/19/66	Mining	1,000,000
N. Fk. Bens Creek	Johnstown, Pa.	6/12/67	Mining	326

The largest kill reported during the period of 1965 through 1967, consisting of approximately 1,000,000 fish, occurred in the Allegheny River downstream from the mouth of the Kiskiminetas River. The operation responsible for the kill was cited as mining.

TABLE 4

Biology Station Description - Conemaugh River Basin

STATION	STA. NO.	SAMPLING AREA	TYPE SAMPLER	DEPTH (In Feet)	SUBSTRATE	BENTHIC FAUNA PREDOMINANCE SEN.	TOL.	V. TOL.	COMMENTS
North Branch Conemaugh Above Wilmar, Pa.	110	R	Q		Gravel Rubble	X	X		
Conemaugh River at Mineral Point, Pa.	111	R	S	.5	Rubble Gravel Rock Silt		X		Acid Pollution
Quemahoning Creek Above Stony Creek	113	R	S	.5	Rock Gravel Silt Rubble	X	X		Evidence of Organic Pollution
Rhoads Creek above Schrocks Run	114	R	Q		Rock Rubble Gravel	X	X		Evidence of Organic Pollution
Stony Cr. @ Kantner, Pa.	115	R	S	.5	Rock Rubble	X	X		
Dark Shade Creek @ Kantner, Pa.	116	R	S	.5	Rock Rubble Gravel		X		Acid Pollution
Clear Shade Creek near Carinbrook, Pa.	117	R	Q		Rock Gravel	X			
Dark Shade Creek below Hillsboro, Pa.	118	R	Q		Rock Gravel	None observed			Acid Pollution

TABLE 4 (continued)

Biology Station Description - Conemaugh River Basin

STATION	STATION NO.	SAMPLING AREA	TYPE SAMPLER	DEPTH (In Feet)	SUBSTRATE	BENTHIC FAUNA PREDOMINANCE SEN.	TOL.	V. TOL.	COMMENTS
Ben's Creek above Mouth	119	R	Q		Rubble Gravel Rock	X			Acid Pollution
Conemaugn River @ Seward, Pa.	121	R	S	.5	Rubble Gravel Silt			X	Acid & Domestic Pollution
Tubmill Creek above Bolivar,Pa.	122	R	Q		Rubble Rock Gravel	X			
No. Fork Black Lick Creek at Rt. 422 Bridge	123	R	S	.5	Rock			X	Acid Pollution
Black Lick Creek above Wehrun,Pa.	124	R	S	.5	Gravel Silt			X	Acid Pollution
Two Lick Creek below Indiana, Pa.	125	R	Q		Rubble Rock Gravel			X	Acid Pollution
Yellow Creek @ Rt. 422 Bridge	126	R	Q		Rubble Gravel Rock	X			
Ramsey Run @ Rt. 422 Bridge	127	R	Q	.5	Rubble	X		X	
Two Lick Cr. below Yellow Creek	128	R	S	.5	Rock Rubble Silt			X	Acid Pollution
Black Lick Cr. near Josephine,Pa	129	R	S	.5	Rubble Gravel Silt			X	Acid Pollution
Conemaugh River below Blairsville, Pa.	130	R	S	.5	Rock Rubble Silt			X	Acid Pollution

KEY

Sampling Area:

P = Pool
R = Riffle

Type Sampler:

P = Peterson dredge
E = Ekman dredge
S = Surber square foot
Q = Qualitative sample

Predominance:

Sen. = Sensitive
Tol. = Tolerant
V. Tol. = Very Tolerant

X = Major Predominance
X = Present
- = Trace

Table 5

COMPOSITION and CLASSIFICATION of ALLEGHENY RIVER BASIN BENTHIC SAMPLES, 1966

ALLEGHENY RIVER BASIN			CLASS I							CLASS II										PERCENTAGE OF TOTAL INDIVIDUALS PER CLASS	
STATIONS	STATION NUMBER	No. of sq. ft. samples	Caddisflies Hydropsychidae	Philopotamidae	Mayflies Baetidae	Heptagenidae	Hellgrammites Corydalidae	Biting Midges Ceratopogonidae	Dragonflies Gomphidae	Beetle Larvae Elmidae	Midge Flies Chironomidae	Snipe Flies Rhagionidae	Black Flies Simulidae	Dance Flies Empididae	TOTAL NUMBER	No./Sq. Ft.	Variety of Forms	% Class I	% Class II
CONEMAUGH RIVER	111	1									33				33	33	1	0	100
QUAMAHONING CREEK	113	1	22				1	1			21	1			46	46	5	52	48
STONEY CREEK	115	1	43		7						66			15	131	131	4	38	62
DARK SHADE CREEK	116	1									32				32	32	1	0	100
CONEMAUGH RIVER	121	2	1								2				3	2	2	33	67
NORTH BRANCH BLACKLICK CREEK	123	1									1				1	1	1	0	100
BLACKLICK CREEK	124	1									5				5	5	1	0	100
RAMSEY RUN	127	1	127	53	2	3		2	2	3	12	1	3		208	208	10	90	10
TWO LICK CREEK	128	1									103				103	103	1	0	100
BLACKLICK CREEK	129	1									57				57	57	1	0	100
KISKIMINETAS RIVER	130	1									140				140	140	1	0	100

APPENDIX C

ECONOMIC PROJECTIONS

TABLE 6

Number and Employment Size of Manufacturing Plants
Conemaugh River Basin

(Cambria, Indiana and Somerset Counties, Pa.)

SIC		Employees 1-19*	20-49	50-99	100-249	250-499	500-999	100-over	Total
20	Food & Kindred Prod.	57	11	5	3				76
21	Tobacco Products	2							2
22	Textile Mill Products	-							-
23	Apparel & Related Prod.	7			7	5	4		23
24	Lumber & Wood Products	99							99
25	Furniture & Fixtures	7							7
26	Paper & Allied Products	2							2
27	Printing & Publishing	29				1			30
28	Chemicals & Allied Prod.	2	2			1			5
29	Petroleum & Coal Prod.	3							3
30	Rubber & Plastic Prod.	3				1			4
31	Leather Products	2				1			3
32	Stone, Clay & Glass Prod.	22	2	2	3				29
33	Primary Metals	4		1	1	1		1	8
34	Fabricated Metal Prod.	19	6			1			26
35	Machinery except Electrical	17	5	1	2		1	1	27
36	Electrical Machinery	3	3						6
37	Transportation Equipment	5	1	2	1				9
38	Instruments & Related Prod.	1	1	1	1	1			5
39	Miscellaneous Mach.	5							5
TOTAL:		289	31	12	18	12	5	2	369

1-19* - Plants from 1963 Census of Manufacturers;other from McGraw-Hill Survey

Source: "Location of manufacturing plants by County, industry and employment size, Census of Manufacturers, 1963," Bureau of the Census, U. S. Department of Commerce; McGraw-Hill Survey of Industrial Plants, 1964.

TABLE 7

Summary of High Water Intake
Manufacturing Plants by Counties
1963

		No. of Plants:	Employment:
Cambria			
2026	Fluid Milk	1	200-499
2051	Bread and related products	1	100-249
3141	Shoes, except rubber	1	100-249
3312	Blast furnaces and steel mills	1	1000 +
3323	Steel foundries	1	1000 +
3399	Primary metal industries	1	100-249
3532	Mining machinery and equipment	1	100-249
3742	Railroad and street cars	1	1000 +
3993	Signs and advertising displays	1	100-249
Indiana			
2037	Frozen fruits and vegetables	1	100-249
3011	Tires and tubes	1	250-499
3442	Metal doors, sash and trim	1	100-249
3532	Mining machinery and equipment	1	100-249
3535	Conveyors	1	500-999
3811	Scientific instruments	1	100-249
3822	Automatic temperature controls	1	500-999
1900	Ordnance and accessories	1	100-249
	" " "	1	250-499
Somerset			
3261	Vitreous Plumbing Fixtures	1	100-249

Source: "Water use in Manufacturing" and "Location of manufacturing plants by counties, industry and employment size, Census of Manufacturing, 1963," Bureau of the Census, U. S. Department of Commerce.

TABLE 8

Summary of Mineral Production in Study Area

		Minerals	($1,000)
Cambria	1965	Coal, Clay, Stone	$51,337
Indiana	1966	Coal, Clay	20,912
Somerset	1966	Coal, Clay and Gravel	19,403
		Subtotal:	$91,652
Indiana		Crude Petroleum & Natural Gas	3,053
Somerset		Crude Petroleum & Natural Gas	909
		Subtotal:	$3,962
		TOTAL:	$95,614

Source: Minerals Yearbook 1966, Volume III, Area Reports

Census of Mineral Industries 1965, Volume II, Area Statistics

Table 9

Conemaugh River Basin
Historical & Projected Employment
By Industry and Total Population
1960-2020

	1960	1980	2000	2020
Agriculture, Forestry and Fisheries	4,944	5,040	2,940	760
Mining	9,837	8,640	4,010	760
Construction	5,269	5,960	6,680	7,710
Manufacturing				
Durables.				
Furniture & Lumber	1,190	1,390	1,220	1,180
Primary Metals	15,751	15,650	14,240	13,310
Fabricated Metals	2,567	4,820	7,190	10,510
Machinery and Electrical Equipment	1,823	2,530	3,740	5,040
Transportation Equipment & Motor Vehicle.	752	990	1,380	1,820
Other Durables	1,662	2,380	3,060	4,080
Non-Durables				
Food	2,009	2,290	2,510	2,900
Textile and Apparel	4,993	7,130	10,110	13,560
Printing	1,054	1,360	1,720	2,170
Chemicals	197	290	370	450
Other Non-Durables	1,159	1,380	1,530	1,810
Transportation, Communication and Utilities.	7,274	9,150	11,020	13,240
Wholesale and Retail Trade	19,589	24,090	27,090	31,780
Finance, Insurance & Real Estate	2,500	3,000	3,930	4,560
Services	20,222	23,340	26,820	31,780
Government	3,062	3,430	4,110	4,760
Unreported Industries	2,095	-	-	-
TOTAL:	107,949	122,860	133,770	152,180
Population	356,099	369,700	399,400	454,960

Table 10

Conemaugh River Basin

Historical and Projected Population

	1960	1980	2000	2020
CAMBRIA COUNTY	203,283	211,870	230,570	263,770
Ebensburg	4,111	4,410	5,070	5,960
Cresson	2,659	2,760	3,010	3,460
South Fork	2,053	1,940	1,650	1,590
Portage	3,933	4,090	4,450	5,090
Nanty Glo	4,608	4,450	4,130	4,250
Cambria	500	520	570	650
Lilly	1,642	1,540	1,380	1,390
Vintondale	938	830	620	530
Ehrenfeld	566	590	640	730
Twin Rocks	950	990	1,080	1,240
Colver	1,261	1,310	1,430	1,640
Johnstown	53,949	54,700	54,250	58,610
INDIANA COUNTY	75,366	78,140	84,420	96,410
Clymer	2,245	2,340	2,510	2,870
Indiana	13,005	14,440	17,520	21,260
Josephine	600	620	670	770
Wehrum	500	520	560	640
Homer City	2,471	2,730	3,220	3,860
Heilwood	600	620	670	770
Black Lick	685	670	640	670
Blairsville	4,930	5,130	5,520	6,310
SOMERSET COUNTY	77,450	79,690	84,410	94,780
Windber	6,994	6,870	6,610	6,990
Roxbury	55	55	60	70
Boswell	1,508	1,550	1,620	1,800
Hooversville	1,120	1,120	1,120	1,210
Hollsopple	900	930	990	1,110
Shanksville	314	430	540	660
Central City	1,604	1,600	1,540	1,630
Stoystown	360	380	380	390
Kantner	350	360	380	430
Jenners	900	930	990	1,110
Jennerstown	422	440	510	600
Cairnbrook	1,100	1,130	1,200	1,350
Jerome	1,241	1,280	1,360	1,530
WESTMORELAND COUNTY	352,629	424,730	503,380	581,870
Derry	3,426	4,370	5,130	5,940

TABLE 11

Index of Gross Output
for
Conemaugh River Basin

1960 = 100

Manufacturing	1980	2000	2020
Food	210	400	825
Textile and Apparel	255	610	1445
Furniture and Lumber	200	335	560
Printing	210	420	850
Chemicals	375	1200	2820
Primary Metals	175	245	370
Fabricated Metals	310	750	1830
Machinery Including Electrical	250	605	1350
Transportation Equipment and Motor Vehicle	185	355	710

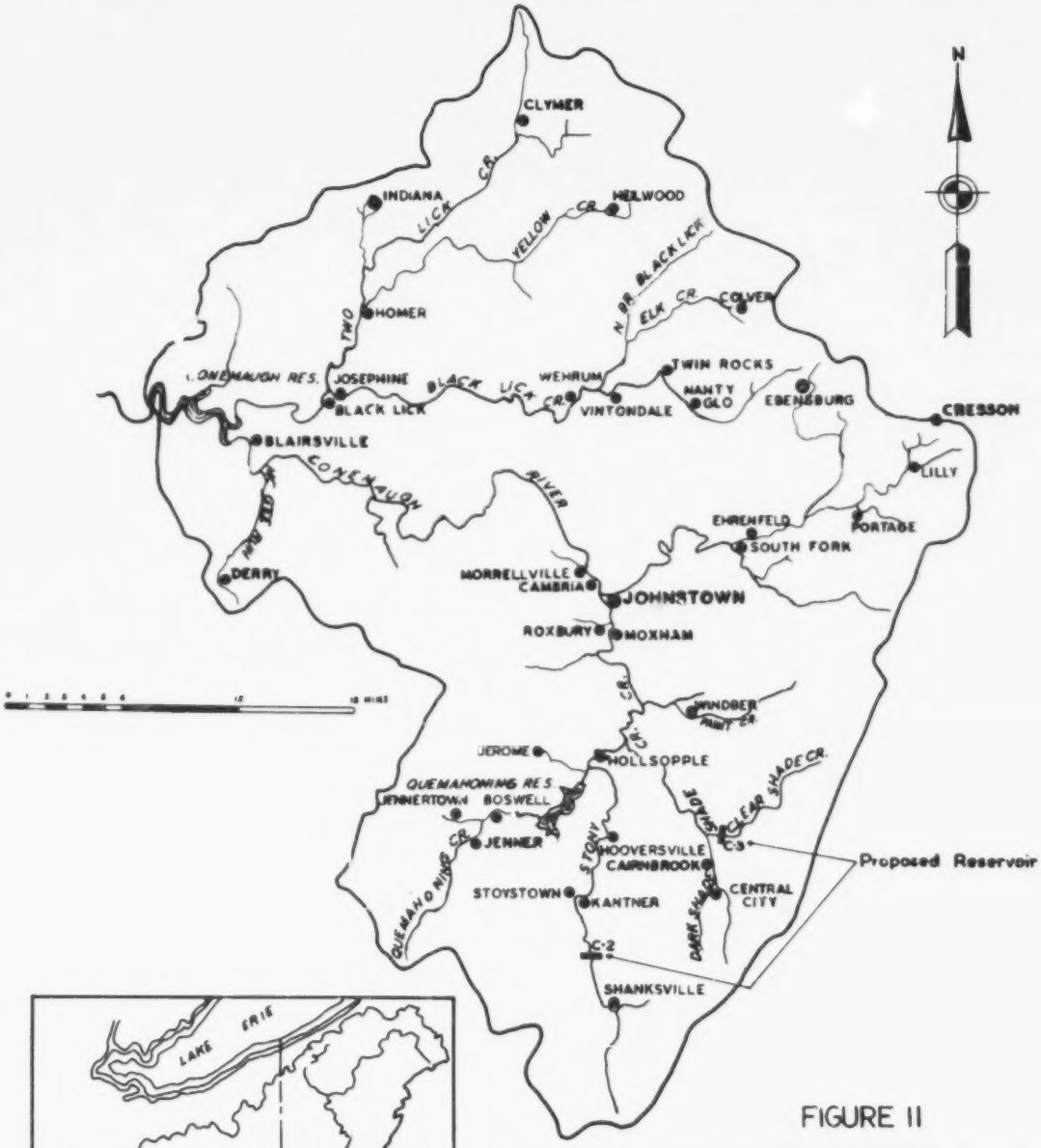


FIGURE 11

UPPER CONEMAUGH RIVER BASIN

LOCATION MAP

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